

GRADE 2 GARDENING & ANIMALS

First edition

8 units

32 lessons

A video for every lesson

FIRST EDITION

COURSE GUIDE

This is a year of real gardening, real animal care and real nature study for second graders. Your child will learn why we have seasons and when crops are ripe, watch for birds and wildlife in the yard, feel the difference between sand, silt and clay, build a compost pile and a worm bin, learn to care for guinea pigs, hamsters, cats and parakeets, and find out how plants make their own food from sunlight. In the spring come goats, cows, horses and honeybees, then repotting, herbs, raised beds and fruit trees, and finally the good bugs, bad bugs and fungi that decide whether a garden thrives.

Each week follows the same simple path: **observe, learn, tend and grow**. Children look closely at a real thing, hear a short and accurate explanation, study a great painting or natural-history print, and then do something with their hands: plant, sort, build, measure, feed or record. A nature journal holds their drawings, measurements and notes all year long.

Behind it all is a simple, grateful view of the world. God made the plants and the animals, and He gave people the work of tending them (Genesis 2:15). A second grader can learn to be a careful, patient and kind steward: to water before the plant wilts, to feed the pet before breakfast, and to say thank you for the harvest.

Fabricando fit faber: by making, one becomes a maker. By growing and tending, a child becomes a gardener.

Most videos come from SciShow Kids, Homeschool Pop, university extension services, zoos and wildlife centers, and well-known gardening and animal-care teachers. Every video was checked for this course. A few gardening channels mention their own seed shops, books or products at the end; you can stop the video when the teaching is done. Watch together, and use the pause button often to talk about what you see.

WHO IT IS FOR

Children about 7 to 8 years old who can listen to a short lesson, follow simple steps with a grown-up nearby, and draw and label in a notebook. Reading is helpful but not required; a parent reads the lessons aloud. No yard, pets or farm animals are needed. Every project can be done with a sunny windowsill, a few pots, a library book, or a visit to a farm, pet store, nature center or neighbor.

HOW TO USE THIS COURSE

1. **The weekly rhythm.** There are 32 lessons, one per week. Each lesson takes two sessions of about 30 to 40 minutes. In Session 1, do the warm-up, read the core ideas aloud, watch the video together and do the picture study. In Session 2, do the hands-on project and the nature-journal page.
2. **The calendar.** The units follow a school year that starts in late summer: harvest and wildlife in the fall, soil and pets in early winter, seeds and plant needs in late winter, farm animals and bees in early spring, planting in spring, and plant health as the garden grows. If your spring comes early or late, shift the units to match your own frost dates. Your county extension office can tell you your average last spring frost and first fall frost.
3. **Picture study.** Show the picture and let your child look quietly for about two minutes. Then put it away and ask your child to tell you everything he or she remembers. Bring it back and work through the “look” prompts and questions. The prompts tie each picture to the science or animal care in the lesson.
4. **The nature journal.** Keep one bound sketchbook or notebook for the whole year. Date every page. Second graders draw what they see, label the parts, record a measurement or a weather note, and write a sentence or two (or dictate it to you). The journal is the best record of the year’s learning.
5. **Videos.** Every lesson has a main video, and many have a backup. The “when” note tells you where it fits. Watch together and pause to talk.
6. **4-H, fairs and record keeping.** Many second graders can join 4-H as Cloverbuds (about ages 5 to 8), and most county fairs have youth classes for vegetables, potted plants, posters and journals. Homeschool families join through the county extension office; check your office or fair book for ages and rules. Build the habit

now: each growing or animal-care log in the nature journal records the date, what was done, what it cost, how much water or feed was used, measurements, and what was learned, just as a 4-H project book asks. Lesson 1.3 shows how to prepare a fair plate of vegetables, and Lesson 7.2 how to show a potted herb.

7. **Unit review and portfolio project.** Each unit ends with a short oral review. You ask the questions aloud, and your child answers by telling, pointing or drawing. There are no points. Each unit also has a portfolio project, a real thing your child makes or does. Take a photo of it and keep it with the journal pages.
8. **Safety and supervision.** A grown-up stays close for every project. Wash hands with soap after touching soil, compost, animals, cages or bird feeders. Never touch or feed wild animals. Wear gloves for compost. Use garden tools only with an adult. Read every label with an adult, and never let a child handle garden chemicals. Lessons with special rules have a safety box.
9. **Living things.** Seeds and plants are needed most weeks. A pet, a worm bin, or visits to animals are welcome but optional. Each pet and farm lesson gives a way to learn well without owning the animal.

SCOPE AND SEQUENCE

UNIT 1 • WEEKS 1–4

Seasons and Harvest

Why the earth has seasons, which crops love cool weather and which love warm, how to tell when food is ripe, and how families dry and store food for winter.

- 1.1 Why We Have Seasons
- 1.2 Cool-Season and Warm-Season Crops
- 1.3 The Harvest Calendar: When Is It Ripe?
- 1.4 Drying and Preserving Food

UNIT 2 • WEEKS 5–8

Backyard Wildlife

Backyard birds and feeders, the mice and moles that live underground, raccoons, opossums and skunks, and how to keep pets and hens safe from coyotes and foxes.

- 2.1 Backyard Birds and Feeders
- 2.2 Mice and Moles Underground
- 2.3 Raccoons, Opossums and Skunks
- 2.4 Coyotes and Foxes: Keeping Pets and Hens Safe

UNIT 3 • WEEKS 9–12

Soil

Sand, silt and clay by feel, dark humus, a compost pile of browns and greens, and a worm bin that turns scraps into rich soil.

- 3.1 Sand, Silt and Clay
- 3.2 Humus: The Dark, Rich Part of Soil
- 3.3 A Compost Pile: Browns and Greens
- 3.4 A Worm Bin

UNIT 5 • WEEKS 17–20

Seeds and What Plants Need

How leaves make food from light, how warmth and frost affect plants, how water climbs up the stem, and the three main plant foods: nitrogen, phosphorus and potassium.

- 5.1 Plants Make Food from Light
- 5.2 Warm and Cold: Temperature and Frost
- 5.3 Water Travels Up the Stem
- 5.4 Plant Food: Nitrogen, Phosphorus and Potassium

UNIT 7 • WEEKS 25–28

Planting

Repotting a houseplant, a windowsill herb garden, building and planting a raised bed, and planting a fruit tree or berry bush.

- 7.1 Repotting a Houseplant
- 7.2 A Windowsill Herb Garden
- 7.3 Raised Beds
- 7.4 Planting a Fruit Tree or Berry Bush

UNIT 4 • WEEKS 13–16

Pets

Caring for small pets and cats: guinea pigs, hamsters and gerbils, cats, and parakeets. Food, homes, cleaning, gentle handling and daily chores.

- 4.1 Guinea Pigs
- 4.2 Hamsters and Gerbils
- 4.3 Cats
- 4.4 Parakeets

UNIT 6 • WEEKS 21–24

Farm Animals and Bees

Goats, dairy and beef cows on grass, horses and ponies, and how honeybees turn flower nectar into honey.

- 6.1 Goats
- 6.2 Dairy and Beef Cows on Grass
- 6.3 Horses and Ponies
- 6.4 From Flower to Honey

UNIT 8 • WEEKS 29–32

Plant Health

Good bugs and bad bugs, slugs, snails and caterpillars, fungi that help and fungi that harm, and how to be a garden detective.

- 8.1 Good Bugs and Bad Bugs
- 8.2 Slugs, Snails and Caterpillars
- 8.3 Fungi That Help and Fungi That Harm
- 8.4 Garden Detective: What's Wrong with My Plant?

WEEKLY PACING CALENDAR

WEEK	PLAN
1	• Session 1: Lesson 1.1 Why We Have Seasons: warm-up, video, teaching and picture study • Session 2: Lesson 1.1 hands-on project and nature journal <i>Two sessions a week is the usual rhythm. Younger children can split a long session in two; older students can do both sessions in one sitting.</i>
2	• Session 1: Lesson 1.2 Cool-Season and Warm-Season Crops: warm-up, video, teaching and picture study • Session 2: Lesson 1.2 hands-on project and nature journal
3	• Session 1: Lesson 1.3 The Harvest Calendar: When Is It Ripe?: warm-up, video, teaching and picture study • Session 2: Lesson 1.3 hands-on project and nature journal
4	• Session 1: Lesson 1.4 Drying and Preserving Food: warm-up, video, teaching and picture study • Session 2: Lesson 1.4 hands-on project and nature journal • Session 3: Unit 1 review and portfolio project
5	• Session 1: Lesson 2.1 Backyard Birds and Feeders: warm-up, video, teaching and picture study • Session 2: Lesson 2.1 hands-on project and nature journal
6	• Session 1: Lesson 2.2 Mice and Moles Underground: warm-up, video, teaching and picture study • Session 2: Lesson 2.2 hands-on project and nature journal
7	• Session 1: Lesson 2.3 Raccoons, Opossums and Skunks: warm-up, video, teaching and picture study • Session 2: Lesson 2.3 hands-on project and nature journal
8	• Session 1: Lesson 2.4 Coyotes and Foxes: Keeping Pets and Hens Safe: warm-up, video, teaching and picture study • Session 2: Lesson 2.4 hands-on project and nature journal • Session 3: Unit 2 review and portfolio project

WEEK	PLAN
9	• Session 1: Lesson 3.1 Sand, Silt and Clay: warm-up, video, teaching and picture study • Session 2: Lesson 3.1 hands-on project and nature journal
10	• Session 1: Lesson 3.2 Humus: The Dark, Rich Part of Soil: warm-up, video, teaching and picture study • Session 2: Lesson 3.2 hands-on project and nature journal
11	• Session 1: Lesson 3.3 A Compost Pile: Browns and Greens: warm-up, video, teaching and picture study • Session 2: Lesson 3.3 hands-on project and nature journal
12	• Session 1: Lesson 3.4 A Worm Bin: warm-up, video, teaching and picture study • Session 2: Lesson 3.4 hands-on project and nature journal • Session 3: Unit 3 review and portfolio project
13	• Session 1: Lesson 4.1 Guinea Pigs: warm-up, video, teaching and picture study • Session 2: Lesson 4.1 hands-on project and nature journal
14	• Session 1: Lesson 4.2 Hamsters and Gerbils: warm-up, video, teaching and picture study • Session 2: Lesson 4.2 hands-on project and nature journal
15	• Session 1: Lesson 4.3 Cats: warm-up, video, teaching and picture study • Session 2: Lesson 4.3 hands-on project and nature journal
16	• Session 1: Lesson 4.4 Parakeets: warm-up, video, teaching and picture study • Session 2: Lesson 4.4 hands-on project and nature journal • Session 3: Unit 4 review and portfolio project
17	• Session 1: Lesson 5.1 Plants Make Food from Light: warm-up, video, teaching and picture study • Session 2: Lesson 5.1 hands-on project and nature journal
18	• Session 1: Lesson 5.2 Warm and Cold: Temperature and Frost: warm-up, video, teaching and picture study • Session 2: Lesson 5.2 hands-on project and nature journal
19	• Session 1: Lesson 5.3 Water Travels Up the Stem: warm-up, video, teaching and picture study

WEEK	PLAN
	Session 2: Lesson 5.3 hands-on project and nature journal
20	- Session 1: Lesson 5.4 Plant Food: Nitrogen, Phosphorus and Potassium: warm-up, video, teaching and picture study - Session 2: Lesson 5.4 hands-on project and nature journal - Session 3: Unit 5 review and portfolio project
21	- Session 1: Lesson 6.1 Goats: warm-up, video, teaching and picture study - Session 2: Lesson 6.1 hands-on project and nature journal
22	- Session 1: Lesson 6.2 Dairy and Beef Cows on Grass: warm-up, video, teaching and picture study - Session 2: Lesson 6.2 hands-on project and nature journal
23	- Session 1: Lesson 6.3 Horses and Ponies: warm-up, video, teaching and picture study - Session 2: Lesson 6.3 hands-on project and nature journal
24	- Session 1: Lesson 6.4 From Flower to Honey: warm-up, video, teaching and picture study - Session 2: Lesson 6.4 hands-on project and nature journal - Session 3: Unit 6 review and portfolio project
25	- Session 1: Lesson 7.1 Repotting a Houseplant: warm-up, video, teaching and picture study - Session 2: Lesson 7.1 hands-on project and nature journal
26	- Session 1: Lesson 7.2 A Windowsill Herb Garden: warm-up, video, teaching and picture study - Session 2: Lesson 7.2 hands-on project and nature journal
27	- Session 1: Lesson 7.3 Raised Beds: warm-up, video, teaching and picture study - Session 2: Lesson 7.3 hands-on project and nature journal
28	- Session 1: Lesson 7.4 Planting a Fruit Tree or Berry Bush: warm-up, video, teaching and picture study - Session 2: Lesson 7.4 hands-on project and nature journal - Session 3: Unit 7 review and portfolio project

WEEK	PLAN
29	• Session 1: Lesson 8.1 Good Bugs and Bad Bugs: warm-up, video, teaching and picture study • Session 2: Lesson 8.1 hands-on project and nature journal
30	• Session 1: Lesson 8.2 Slugs, Snails and Caterpillars: warm-up, video, teaching and picture study • Session 2: Lesson 8.2 hands-on project and nature journal
31	• Session 1: Lesson 8.3 Fungi That Help and Fungi That Harm: warm-up, video, teaching and picture study • Session 2: Lesson 8.3 hands-on project and nature journal
32	• Session 1: Lesson 8.4 Garden Detective: What's Wrong with My Plant?: warm-up, video, teaching and picture study • Session 2: Lesson 8.4 hands-on project and nature journal • Session 3: Unit 8 review and portfolio project <i>Last week. Hold a family harvest fair: set out the best project from each unit (journal pages, plants, photos of animal care) and let the student show guests one of them.</i>

MATERIALS

Nature journal (sketchbook or bound notebook)

One for the whole year, for drawings, labels, measurements and notes.

Colored pencils, a pencil and a ruler

For journal pages and measuring plant growth.

Magnifying glass

For seeds, soil, insects, leaves and feathers.

Seeds

Beans, peas, radishes, lettuce, sunflowers, marigolds, and herbs such as basil and parsley.

Potting mix and pots or cups with drainage holes

Used in many lessons. Plastic cups work if a grown-up pokes holes in the bottom.

Clear jars, zip bags, paper towels and a spray bottle

For soil jars, sprouting seeds and simple experiments.

Watering can and a small trowel

Garden tools are used with an adult nearby.

Garden gloves

For compost, soil and handling rough plants.

A thermometer

For checking warm and cold places, frost, and compost heat.

Celery and food coloring

For the water-travels-up-the-stem test in Unit 5.

Worm bin (optional)

A plastic tote with holes and red wiggler worms, or a store-bought bin. A friend's bin or a library book also works.

A houseplant to repot and a fruit tree or berry bush to plant (optional)

For Unit 7. A pot of strawberries on a balcony is fine.

Simple bird feeder and seed (optional)

Black-oil sunflower seed draws the most birds.

GRADING

There are no letter grades in second grade. Progress is shown by what your child can do, tell and make, and by a growing portfolio of journal pages and photos.

- After each unit, write two or three sentences of narrative feedback: what your child observed well, what he or she can now explain, and one habit to keep working on (for example, watering without reminders, or washing hands after handling animals).
- Keep a portfolio folder with the best journal pages, the unit portfolio project photos, and a few growth logs. Look back through it at the end of each unit and at the end of the year.
- Use the mastery checklist at the start of each unit as your guide. When your child can show or tell each item, the unit is done well.
- Praise careful looking, patience and faithful daily care more than neat drawings.

A NOTE TO PARENTS

You do not need to be a gardener or a farmer to teach this course. You only need to be willing to look closely alongside your child, ask “What do you notice?”, and let some seeds fail. A wilted plant or a moldy cup teaches as much as a perfect harvest,

and children learn diligence best by watching a parent keep small promises day after day.

Some lessons speak plainly about how farm animals give us milk, eggs, wool, work and meat, and about predators that eat other animals. We tell the truth gently and simply, and we never show anything upsetting. Throughout the year, we want children to see God's goodness in seedtime and harvest, to treat animals with kindness, and to give thanks for their daily bread.

UNIT 1

SEASONS AND HARVEST

The school year begins at harvest time. In this unit your child learns why the earth has seasons, why some vegetables love cool weather and others need summer heat, how a gardener knows when food is ripe, and how families long ago (and today) dry and store food so there is something to eat all winter.

The pictures we study are a haystack painted by Claude Monet, Camille Pissarro's kitchen gardens, Pieter Bruegel's *The Harvesters*, and a Spanish still life of a winter pantry. The projects use a lamp and a ball, seed packets, the grocery store or garden, and apples or herbs to dry.

PREREQUISITES

- Can name the four seasons
- Knows that plants grow from seeds
- Can draw a simple picture and label it with help

MASTERY CHECKLIST

- ☐ I can show with a ball and a lamp why summer is warm and winter is cold.
- ☐ I can name two cool-season crops and two warm-season crops.
- ☐ I can tell two signs that a fruit or vegetable is ripe.
- ☐ I can explain why drying food keeps it from spoiling.
- ☐ I can thank God for the harvest and name foods that grow in my area.

LESSONS IN THIS UNIT

1.1 Why We Have Seasons

2 sessions of 30–40 minutes

1.2 Cool-Season and Warm-Season Crops

2 sessions of 30–40 minutes

1.3 The Harvest Calendar: When Is It Ripe?

2 sessions of 30–40 minutes

1.4 Drying and Preserving Food

2 sessions of 30–40 minutes

UNIT 1 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing or using the ball-and-lamp model. There are no points; listen for understanding and praise careful answers.

1. Use the orange and the lamp to show me where the earth is when it is summer for us. Why is it warmer then?
2. Name two cool-season crops and two warm-season crops.
3. What happens to a tomato plant on a frosty night?
4. Tell me two ways you can tell if a fruit or vegetable is ripe.
5. Why does a dried apple ring last longer than a fresh apple slice?
6. In the painting *The Harvesters*, what are the people doing and why are they working so hard?

ANSWER KEY

1. Our half of the earth tilts toward the sun, so sunlight shines more straight down and the days are longer.
2. Cool-season: lettuce, peas, radishes, spinach, carrots, cabbage, kale. Warm-season: tomatoes, peppers, beans, corn, cucumbers, squash, melons.
3. The frost freezes it; the leaves turn black and the plant dies, because tomatoes are warm-season crops.
4. Any two: color, size, feel (soft or firm), smell, taste, or counting the days to maturity on the seed packet.
5. Most of the water is gone, and mold and bacteria need water to grow.
6. They are cutting and bundling ripe wheat. They must bring it in while it is ripe and the weather is dry.

PORTFOLIO PIECE: A HARVEST THANKSGIVING BOARD

Make a poster or a table display that shows the harvest where you live. Include your harvest calendar, a photo or drawing of your fall salad pot, and your jar of dried apples or herbs. Add a card that lists five foods you are thankful for and where each one grows.

LOOK FOR	WHAT IT MEANS
Seasons	Can explain, with the poster or the model, why we have summer and winter.
Harvest calendar	Shows at least six local foods placed in the right months.
Growing and preserving	Includes the salad pot (or a drawing of it) and a labeled jar of dried food.
Thankfulness	Lists five foods with a sentence of thanks, told or written.

1.1 WHY WE HAVE SEASONS

OBJECTIVES

- Tell that the earth travels around the sun once a year.
- Show that the earth is tilted, so sunlight hits our part of the world more directly in summer.
- Notice how plants and gardens change with the seasons.

Warm-up. Look out the window together. Name three things that tell you what season it is right now: the color of the leaves, what people are wearing, how high the sun is at lunchtime, what is growing in gardens. Draw one of them in the corner of a journal page.

WATCH

Why Are There Seasons?

[SciShow Kids](#) · 2:20

<https://www.youtube.com/watch?v=UQjT5uKp2hg>

WHEN TO WATCH

After the core ideas. Pause when the earth tilts toward the sun and point to where we live.

BACKUP VIDEO

Why Do We Have Different Seasons? | California Academy of Sciences

[California Academy of Sciences](#) · 3:17

https://www.youtube.com/watch?v=WgHmqv_-UbQ

A quiet animation of the earth going around the sun. Watch the month names and the sunlight lines.

KEY TERMS

season

One of the four parts of the year: spring, summer, fall (autumn) and winter.

orbit

The path the earth travels around the sun. One trip takes one year.

tilt

The earth leans to one side as it travels,
like a top that is leaning a little.

direct sunlight

Sunlight that shines straight down,
which makes the ground warmer.

CORE IDEAS

The earth is always moving. It spins around once every day, which gives us day and night. It also travels in a big circle around the sun. One whole trip around the sun takes one year.

The earth does not stand up straight. It leans, or **tilts**, a little to one side, and it keeps leaning the same way all year long. For part of the year, our half of the earth leans toward the sun. For part of the year, it leans away.

When our half leans toward the sun, the sunlight shines more straight down on us. The sun climbs high in the sky, and the days are long. That is **summer**. When our half leans away, the sunlight comes in low and slanting, the days are short, and the ground cools off. That is **winter**. Spring and fall are the in-between times.

Plants and animals know the seasons. Seeds sprout in the warm spring. Gardens grow fast in long summer days. In fall, leaves change color, crops ripen, and squirrels store nuts. In winter, many plants rest until spring comes again.

God promised Noah that the seasons would keep coming, year after year. Farmers and gardeners trust that promise. They plant in spring because they know summer and harvest will follow.

PICTURE STUDY



Haystacks, End of Summer, Claude Monet, 1891 · Oil on canvas · Art Institute of Chicago

Image: [Wikimedia Commons](#), public domain

Claude Monet lived in a French village surrounded by farm fields. After the harvest, farmers piled the grain into tall stacks near his house. Monet painted the very same stacks again and again: in summer, in fall, in winter snow, in the morning and at sunset. He wanted to show how the light changes with the seasons.

Look closely

- Find the two big stacks. What do you think they are made of?
- Look at the shadows. Are they long or short? Long shadows come when the sun is lower in the sky.
- What color is the field? Is the grass green and growing, or golden and dry?
- Look at the trees in the back. Do they still have their leaves?

Talk about it

1. What season do you think it is in this painting? What clues tell you?
2. Why would farmers stack the grain up high instead of leaving it on the ground?
3. If Monet painted these same stacks in January, what would look different?

HANDS-ON PROJECT

A Ball-and-Lamp Earth

You will make a little earth and walk it around a “sun” to see why our part of the world has summer and winter.

You will need

- A lamp with the shade taken off (or a bright flashlight standing on end)
- An orange, apple or small ball
- A pencil or skewer (a grown-up pushes it through the fruit)
- A sticker or marker dot
- A dark room

Steps

1. Ask a grown-up to push the pencil straight through the orange from top to bottom. The pencil is the line the earth spins around.
2. Put a sticker about halfway between the middle and the top of the orange. That is about where we live.
3. Set the lamp in the middle of the table and turn off the other lights. The lamp is the sun.
4. Hold the orange so the pencil leans a little to one side, toward the wall. Keep it leaning the same way the whole time.
5. Walk slowly in a big circle around the lamp. Do not change the way the pencil leans.
6. Stop on the side where the top of the pencil leans toward the lamp. Look at the sticker. It gets bright, straight-on light. This is our summer.
7. Walk to the opposite side. Now the top leans away. The sticker gets dimmer, slanting light. This is our winter.
8. Stop halfway between. Neither end leans toward the sun. This is spring or fall.

Tips

- The hardest part is keeping the tilt pointing the same way. Pick a spot on the wall and keep the pencil leaning toward it.
- Spin the orange slowly as you walk to show day and night too.

Check your work

- ☐ I kept the earth tilted the same way all the way around.
- ☐ I can show where the earth is in summer and where it is in winter.
- ☐ I can say why summer days are warmer.

NATURE JOURNAL

1. Draw the lamp sun and two oranges: one in summer and one in winter. Draw the pencil tilting the same way in both. Label *summer* and *winter*.
2. Make a four-box page: one box for each season. Draw what a garden or a tree looks like in each one.
3. Go outside at lunchtime and stand with your back to the sun. Have someone trace your shadow with chalk, or measure it. Write the date. Measure it again in December.

COMMON MISTAKES

- Thinking summer is warm because the earth is closer to the sun. It is the tilt, not the distance, that makes the seasons.
- Turning the pencil as you walk around the lamp. The earth always leans the same way.

Make it a game • Orbit Walk and Tilt Test. Hold a ball and walk once around a lamp, keeping the ball's tilt pointed at the same corner of the room. Stop at four spots and say which season your spot has and whether the light hits you directly. Your grown-up gets one point for every answer you explain without help.

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)

After the flood, God promised that the seasons would keep coming. Every spring and every harvest reminds us that God keeps His promises.

1.2 COOL-SEASON AND WARM-SEASON CROPS

OBJECTIVES

- Sort common vegetables into cool-season and warm-season crops.
- Tell that cool-season crops can handle a light frost but warm-season crops cannot.
- Plant a cool-season crop such as lettuce or radishes in the fall.

Warm-up. Lay out pictures or real vegetables: lettuce, a carrot, peas, a radish, a tomato, a pepper, a cucumber, a pumpkin, sweet corn. Ask: “Which ones do you think like chilly weather? Which ones need hot summer days?” Make two piles and see how close you were by the end of the lesson.

WATCH

What's the Difference? Cool Season and Warm Season Crops

K-State Extension · 3:11

<https://www.youtube.com/watch?v=UPIhm23NbfU>

WHEN TO WATCH

After the warm-up sort. Listen for which crops the extension specialist calls cool-season, then check your piles.

BACKUP VIDEO

14 Vegetables & Herbs you Can Grow in Cold Weather

Next Level Gardening · 6:16

<https://www.youtube.com/watch?v=izGhyNgDe70>

After the project. Count how many of the 14 cold-weather crops you already know.

KEY TERMS

crop

A plant people grow for food or other uses.

cool-season crop

A crop that grows best in cool spring or fall weather and can handle a light frost, like lettuce, peas, spinach, radishes, carrots and cabbage.

warm-season crop

A crop that needs warm soil and hot days and is killed by frost, like tomatoes, peppers, beans, corn, cucumbers, squash and melons.

frost

Ice crystals that form on plants when the air gets down to freezing, 32 °F (0 °C).

CORE IDEAS

Not every vegetable likes the same weather. Some love cool days. Some need summer heat. A wise gardener plants each crop at the right time.

Cool-season crops grow best when the days are cool, about like a sweater day. Lettuce, spinach, peas, radishes, carrots, beets, cabbage, broccoli and kale are cool-season crops. Many of them can live through a light frost. Some, like kale and carrots, even taste sweeter after a frost.

Warm-season crops need warm soil and hot, sunny days. Tomatoes, peppers, green beans, sweet corn, cucumbers, squash, pumpkins and melons are warm-season crops. One frosty night can turn their leaves black and kill them. We plant them only after the last frost in spring.

Because of this, a garden can have two or even three plantings a year. Cool-season crops go in early in spring. Warm-season crops go in when the weather is warm. Then, as summer ends, gardeners plant cool-season crops again for a fall harvest.

Right now, in late summer or early fall, is a good time to sow fast cool-season crops like radishes, lettuce and spinach. Radishes can be ready to pull in about four weeks.

PICTURE STUDY



Kitchen Gardens at L'Hermitage, Pontoise, Camille Pissarro, 1874 · Oil on canvas · Scottish National Gallery, Edinburgh

Image: [Wikimedia Commons](#), public domain

Camille Pissarro loved to paint the vegetable gardens near the French village where he lived. Families grew food for their tables in small plots, called kitchen gardens. Look for the rows and the people tending them.

Look closely

- Find the long rows of vegetables. Do all the plots look the same, or do some look different?
- Find a person working in the garden. What might he or she be doing?
- Look at the trees and the sky. What season do you think it is?
- Do you see any bare soil? A gardener might be getting ready to plant the next crop there.

Talk about it

1. If you had a kitchen garden like this, what cool-season crop would you plant in the fall?
2. Why do you think the families planted their gardens close to their houses?
3. What would this garden look like after the first hard frost?

Safety first. Wash your hands after working in the soil. Ask a grown-up before you eat anything from the garden.

HANDS-ON PROJECT

A Fall Salad Pot

You will plant cool-season crops for a fall harvest. Radishes and lettuce grow quickly and do not mind chilly nights.

You will need

- A wide pot or window box at least 6 inches deep, with drainage holes (or a sunny garden spot)
- Potting mix
- Radish seeds and loose-leaf lettuce seeds
- A ruler
- A watering can
- Two plant labels or craft sticks

Steps

1. Fill the pot with potting mix to about one inch below the rim. Water it until it is damp all the way through.
2. Read the seed packets with a grown-up. Find how deep to plant and how many days until harvest. Write the days on your labels.
3. On one side, poke holes about half an inch deep and two inches apart. Drop one radish seed in each hole.
4. On the other side, sprinkle lettuce seeds thinly over the soil. Lettuce seeds are tiny and need light, so cover them with only a dusting of soil.
5. Pat the soil gently and water with a gentle sprinkle so the seeds do not wash away.
6. Put the pot where it gets at least six hours of sun. Push in your labels.
7. Keep the soil damp like a wrung-out sponge. Check it every day with your finger.
8. When the seedlings are crowded, thin them so the radishes stand about two inches apart. You can eat the tiny lettuce thinnings.

Tips

- Radishes often sprout in only three to five days. Lettuce takes about a week.
- If a hard frost is coming, bring the pot into a garage or cover it with an old sheet overnight.

Check your work

- ☐ I can name three cool-season crops and three warm-season crops.
- ☐ I planted my seeds at the right depth.
- ☐ I checked and watered my pot without being reminded.

NATURE JOURNAL

1. Draw a T-chart. On one side draw and label four cool-season crops. On the other side draw and label four warm-season crops.
2. Start a growth log for your fall salad pot: the date you planted, the day the first sprout came up, and the height every few days.
3. Draw a radish seedling when it first comes up. How many leaves does it have? What shape are they?

COMMON MISTAKES

- Planting tomatoes or beans in the fall. They need heat and will die at the first frost.
- Burying lettuce seeds too deep. Tiny seeds need just a sprinkle of soil on top.

Make it a game • Frost Sorting Race. Write cool-season and warm-season on two sheets. Your grown-up calls out vegetables: lettuce, peas, tomatoes, spinach, squash, cucumbers. Sprint to place each name card on the right sheet and say whether a light frost would hurt it. Try to sort ten vegetables in under sixty seconds and then beat that time.

1.3 THE HARVEST CALENDAR: WHEN IS IT RIPE?

OBJECTIVES

- Tell that different foods ripen at different times of the year.
- Use color, size, smell, feel and the seed packet to decide when food is ripe.
- Make a simple harvest calendar for foods grown in your area.

Warm-up. Hold a ripe banana and a green banana (or a ripe and an unripe tomato or peach). Use your senses one at a time: How do they look? How do they feel when you squeeze gently? How do they smell? Tell three differences.

WATCH

How to Tell When Your Fruits and Vegetables are Ready to Harvest

GrowVeg • 5:29

<https://www.youtube.com/watch?v=8gCt675555o>

WHEN TO WATCH

After the core ideas. Pause after each crop and say which sense the gardener used: looking, feeling, smelling or tasting.

BACKUP VIDEO

3 Signs Your Carrots Are Ready - Garden Quickie Episode 167

The Ripe Tomato Farms • 3:11

<https://www.youtube.com/watch?v=HBw19-wAFzA>

A close look at one crop: how a gardener knows when carrots are ready under the ground.

KEY TERMS

ripe

Fully grown and ready to pick and eat.

harvest

Gathering in the crops when they are ready. Also the crops themselves.

days to maturity

The number printed on a seed packet that tells about how long a plant takes to be ready to harvest.

calendar

A chart of the months of the year.

CORE IDEAS

Every food has its own time to be ready. Strawberries and peas come early in summer. Tomatoes, sweet corn and peaches come in the heat of late summer. Apples, pumpkins, winter squash and potatoes come in the fall. A **harvest calendar** shows what is ready in each month.

Gardeners use their senses to tell when food is **ripe**. They look at the **color**: a tomato turns from green to red, a pepper from green to red or yellow. They check the **size**: a cucumber or zucchini is best when it is medium, not giant. They **feel**: a ripe peach gives a little when pressed gently, and a ripe watermelon sounds hollow when tapped. They **smell**: a ripe melon smells sweet at the stem end.

Some crops hide underground. To check a carrot or potato, a gardener brushes back the soil to peek at the top, or pulls just one to see. Potatoes are ready when the green tops turn yellow and die back.

The seed packet helps too. It tells the **days to maturity**. If radishes take 25 days and you planted them on September 1, you can start checking them near the end of September.

Pick food at the right time. If you wait too long, beans turn tough, zucchini grow huge and seedy, and fruit drops or rots. If you pick too early, it may be hard and sour. Picking often also tells many plants to keep making more.

PICTURE STUDY



The Harvesters, Pieter Bruegel the Elder, 1565 · Oil on wood · Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Pieter Bruegel painted a set of pictures showing the farm year, one for each season. This one shows the grain harvest in late summer. The whole village has come out to cut the wheat while it is ripe and the weather is dry.

Look closely

- Find the workers cutting the wheat. What tool are they using?
- Find the bundles of wheat tied up and standing in the field. These are called sheaves.
- Find the people eating lunch under the tree. What foods can you spot?
- Look at the color of the wheat. How can you tell it is ripe and ready?

Talk about it

1. Why do you think everyone in the village helps at harvest time?
2. What might happen if they waited too long to cut the wheat?
3. How is this harvest the same as, and different from, picking food in a garden today?

Safety first. Pick only with a grown-up's permission, and wash fruit and vegetables before eating. Never eat a wild berry or mushroom you find outdoors.

HANDS-ON PROJECT

My Harvest Calendar and a Fair Plate

You will make a twelve-month chart that shows when favorite foods are ripe where you live, and you will practice telling ripe from unripe.

You will need

- A large sheet of paper
- A ruler and colored pencils or markers
- Seed packets, a seed catalog, or a printed harvest chart from your state's extension service or farmers' market
- A few fruits and vegetables from a garden, farm stand or store

Steps

1. Draw a grid with twelve boxes, one for each month. Write the month names in order, starting with January.
2. With a grown-up, look up when six to eight foods are ripe in your state. Try strawberries, peas, tomatoes, sweet corn, apples, pumpkins and potatoes.
3. Draw each food in the month or months when it is ready. Some foods, like apples, will go in more than one month.
4. Color the summer months yellow, the fall months orange, the winter months blue and the spring months green, lightly in the background.
5. Look at your calendar. Which season has the most food? Which has the least?
6. Now do a ripeness test. Take two of the same fruit, one riper than the other. Use your eyes, fingers and nose to tell which is ripe, then cut them open with a grown-up to check.
7. Make a fair plate: from your garden, a farm stand or the store, choose 3 to 5 of one vegetable (carrots, peppers or potatoes) that match in size, shape and color, are ripe but not overgrown, and have no cuts, bruises or bug holes. Gently brush off the dirt (do not scrub or polish), trim tops neatly if your fair book says to, set them on a paper plate, and write a label with the name of the vegetable and its variety.
8. Hang your harvest calendar in the kitchen.

Tips

- A farmers' market is a wonderful place to see what is ripe this week. Ask a farmer how he knows when to pick.
- Fall is apple time in much of the country. Visit an orchard if you can.
- Many county fairs have a youth vegetable class, and this is exactly what the judges look for: plates that match (uniform), look like the variety should (true to type), are clean and unblemished, and are correctly labeled. Check your county fair book for the rules and the number to show.

Check your work

- ☐ My calendar shows at least six foods in the right months.
- ☐ I can name two signs that a food is ripe.
- ☐ I can tell which season has the biggest harvest where I live.
- ☐ I can name four things a fair judge looks for in a plate of vegetables.

NATURE JOURNAL

1. Draw a tomato three times: green, turning orange, and ripe red. Label each one.
2. Draw something you harvested or bought this week. Write how you knew it was ripe.
3. Write the number of days to maturity from two seed packets. Count forward on a calendar to find when each would be ready.
4. Keep a record like a 4-H project book: the date, the vegetables you chose for your fair plate, why you chose them, and what you would do better next time.

COMMON MISTAKES

- Waiting too long to pick zucchini and beans. Check them every day or two in summer.
- Yanking on fruit that will not come off easily. Ripe fruit often lets go with a gentle twist.

Make it a game • Ripe or Not Riddles. Your grown-up reads a riddle: I am red, a little soft, and smell sweet. What am I, and am I ripe? Answer with the food and the clue. Then you write your own riddle using color, size, smell, feel or the seed packet. Score a point when the other person guesses right.

Scripture. “To every thing there is a season, and a time to every purpose under the heaven: A time to be born, and a time to die; a time to plant, and a time to pluck up that which is planted;” (Ecclesiastes 3:1-2, KJV)

There is a right time to plant and a right time to pick. A good gardener watches and waits for the right time, just as Bruegel’s farmers waited for the wheat to turn gold.

1.4 DRYING AND PRESERVING FOOD

OBJECTIVES

- Tell that food spoils because tiny living things grow on it, and they need water.
- Name ways families keep food for winter: drying, cold storage, freezing and canning.
- Dry apple rings or a bundle of herbs.

Warm-up. Compare a fresh grape and a raisin (or a fresh apple slice and a dried one). How are they different in size, color, feel and taste? Where did the water go?

WATCH

Dehydrate Apples for Long Term Apple Storage

Stark Bro's · 3:33

<https://www.youtube.com/watch?v=5L2e5OH5WUk>

WHEN TO WATCH

Before the hands-on project. Watch how thin the apple slices are cut, and why.

BACKUP VIDEO

Never Use an Oven or Dehydrator to Dry Herbs Again With This Century Old Method

Mlgardener · 8:29

https://www.youtube.com/watch?v=yq7XxzQtg_k

If you choose to dry herbs. The bundling and hanging is shown in the last minute.

KEY TERMS

spoil

To go bad, get moldy or rot so it is not safe to eat.

dry (dehydrate)

To take most of the water out of food so mold and bacteria cannot grow.

preserve

To keep food from spoiling so it can be eaten later.

root cellar

A cool, dark room, often underground, where potatoes, apples and other crops keep for months.

CORE IDEAS

At harvest time there is often more food than a family can eat right away. Long ago, before stores and refrigerators, families had to save the summer's food or they would be hungry in winter. Saving food so it does not go bad is called **preserving**.

Food **spoils** because tiny living things, too small to see, start to grow on it. Mold and bacteria need water, warmth and time. Take away one of those, and the food lasts longer.

Drying takes the water away. Raisins are dried grapes. Prunes are dried plums. People dry apple rings, beans, corn, peppers and herbs. Long ago they hung them from the rafters or strung them by the fire. Today we can use a warm oven or a food dryer.

Cold slows the tiny living things down. Families stored potatoes, carrots, cabbages and apples in a cool, dark **root cellar**. Today we use the refrigerator and the freezer.

Canning means heating food in sealed jars so nothing can grow inside. Grown-ups do the canning, because the jars and water are very hot. Jams, pickles, applesauce and tomatoes are often canned.

Preserving food is hard work, but it is a way of being thankful and wise. Nothing God gave in the harvest goes to waste.

PICTURE STUDY



Still Life with Quince, Cabbage, Melon and Cucumber, Juan Sánchez Cotán, about 1602 · Oil on canvas ·
San Diego Museum of Art

Image: [Wikimedia Commons](#), public domain

In Spain long ago, people kept fruit and vegetables in a cool, shady window ledge called a *cantarero*. Hanging food on strings let air flow all around it and kept it away from mice. Juan Sánchez Cotán painted his pantry window so carefully that the food looks real enough to touch. Later in life he became a monk.

Look closely

- Find the two foods hanging on strings. Why would someone hang food instead of setting it down?
- Find the cut melon. Will it keep as long as the whole cabbage? Why or why not?
- Look at the dark space around the food. Is this place warm and sunny or cool and shady?
- Count the foods. Which do you think would last the longest?

Talk about it

1. How is this window like a refrigerator or a root cellar?
2. What foods in your house are dried, canned or frozen?

3. Why do you think the painter made the food look so careful and beautiful?

Safety first. A grown-up does all the cutting and runs the oven. Hot trays and dried fruit fresh from the oven can burn. Wash your hands before handling food.

Apple Rings or Herb Bundles

You will preserve a little of the harvest by drying it, just as families have done for hundreds of years. Choose apple rings, herb bundles, or both.

You will need

- 2 or 3 apples, an apple corer and a sharp knife (grown-up only)
- A bowl of water with a squeeze of lemon juice
- A baking sheet with a cooling rack, or a long piece of clean string
- Or: a handful of fresh herbs with long stems (mint, oregano, thyme, rosemary or sage) and twine
- A clean jar with a lid
- A kitchen scale (optional)

Steps

1. Wash the apples. A grown-up cores them and cuts them into thin rings, about as thick as a coin.
2. Dip the rings in the lemon water for a minute. This keeps them from turning brown.
3. Pat them dry and lay them on the rack, not touching. If you have a scale, weigh them first and write it down.
4. Oven method: a grown-up bakes them at the oven's lowest setting (about 170 to 200 °F) for 2 to 3 hours, turning once, until they feel leathery. String method: thread the rings on a string and hang them in a warm, dry place for one to two weeks.
5. For herbs: snip long stems, rinse and shake dry, then tie 5 or 6 stems together at the bottom with twine. Hang the bundle upside down in a dry, airy spot out of the sun for one to two weeks.
6. When the apples are leathery or the herb leaves crumble, they are dry. Weigh the apples again. How much lighter are they? That was water.
7. Store your dried food in a clean, closed jar. Label it with the name and date.

Tips

- Thin slices dry faster and more evenly.
- If you see any mold, throw that piece away. It was not dry enough.

Check your work

- ☐ I can tell why dried food keeps longer.
- ☐ I can name three ways to preserve food.
- ☐ I labeled my jar with the food and the date.

NATURE JOURNAL

1. Draw an apple ring before and after drying. Write how it changed in size, color and feel.
2. Draw a root cellar with shelves of potatoes, apples, carrots and jars. Label what is stored there.
3. List three foods in your kitchen that are dried, three that are canned and three that are frozen.

From history. Before refrigerators, many American farm families dug a root cellar into a hillside or under the house. The earth kept it cool in summer and kept it from freezing in winter. Pioneer families also strung apple slices and green beans on threads to dry by the fireplace. They called the dried beans “leather britches.”

COMMON MISTAKES

- Cutting slices too thick. They stay wet in the middle and can mold.
- Storing food in a jar before it is completely dry.

Make it a game • Keep It for Winter. Set a timer for sixty seconds and name every way a family can keep food for winter. Your grown-up tallies drying, cold storage, freezing and canning. Then explain why food spoils: tiny living things need water to grow. Two truths and a tall tale: say three facts and let your grown-up spot the tall one.

UNIT 1

SEASONS AND HARVEST

The school year begins at harvest time. In this unit your child learns why the earth has seasons, why some vegetables love cool weather and others need summer heat, how a gardener knows when food is ripe, and how families long ago (and today) dry and store food so there is something to eat all winter.

The pictures we study are a haystack painted by Claude Monet, Camille Pissarro's kitchen gardens, Pieter Bruegel's *The Harvesters*, and a Spanish still life of a winter pantry. The projects use a lamp and a ball, seed packets, the grocery store or garden, and apples or herbs to dry.

PREREQUISITES

- Can name the four seasons
- Knows that plants grow from seeds
- Can draw a simple picture and label it with help

MASTERY CHECKLIST

- ☐ I can show with a ball and a lamp why summer is warm and winter is cold.
- ☐ I can name two cool-season crops and two warm-season crops.
- ☐ I can tell two signs that a fruit or vegetable is ripe.
- ☐ I can explain why drying food keeps it from spoiling.
- ☐ I can thank God for the harvest and name foods that grow in my area.

LESSONS IN THIS UNIT

1.1 Why We Have Seasons

2 sessions of 30–40 minutes

1.2 Cool-Season and Warm-Season Crops

2 sessions of 30–40 minutes

1.3 The Harvest Calendar: When Is It Ripe?

2 sessions of 30–40 minutes

1.4 Drying and Preserving Food

2 sessions of 30–40 minutes

UNIT 1 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing or using the ball-and-lamp model. There are no points; listen for understanding and praise careful answers.

1. Use the orange and the lamp to show me where the earth is when it is summer for us. Why is it warmer then?
2. Name two cool-season crops and two warm-season crops.
3. What happens to a tomato plant on a frosty night?
4. Tell me two ways you can tell if a fruit or vegetable is ripe.
5. Why does a dried apple ring last longer than a fresh apple slice?
6. In the painting *The Harvesters*, what are the people doing and why are they working so hard?

ANSWER KEY

1. Our half of the earth tilts toward the sun, so sunlight shines more straight down and the days are longer.
2. Cool-season: lettuce, peas, radishes, spinach, carrots, cabbage, kale. Warm-season: tomatoes, peppers, beans, corn, cucumbers, squash, melons.
3. The frost freezes it; the leaves turn black and the plant dies, because tomatoes are warm-season crops.
4. Any two: color, size, feel (soft or firm), smell, taste, or counting the days to maturity on the seed packet.
5. Most of the water is gone, and mold and bacteria need water to grow.
6. They are cutting and bundling ripe wheat. They must bring it in while it is ripe and the weather is dry.

PORTFOLIO PIECE: A HARVEST THANKSGIVING BOARD

Make a poster or a table display that shows the harvest where you live. Include your harvest calendar, a photo or drawing of your fall salad pot, and your jar of dried apples or herbs. Add a card that lists five foods you are thankful for and where each one grows.

LOOK FOR	WHAT IT MEANS
Seasons	Can explain, with the poster or the model, why we have summer and winter.
Harvest calendar	Shows at least six local foods placed in the right months.
Growing and preserving	Includes the salad pot (or a drawing of it) and a labeled jar of dried food.
Thankfulness	Lists five foods with a sentence of thanks, told or written.

UNIT 2

BACKYARD WILDLIFE

Fall is a busy time for the wild animals that share our yards. In this unit your child learns to recognize common backyard birds and feed them well, discovers the mice and moles that live underground, meets the night visitors (raccoons, opossums and skunks), and learns about coyotes and foxes and how families keep pets and hens safe from them.

Our pictures come from the great American naturalist John James Audubon and his son John Woodhouse Audubon, who painted birds and mammals from life. The most important rule of the whole unit is simple: **look, but do not touch**. We watch wild animals from a safe distance, and we never feed or pet them.

PREREQUISITES

- Can sit quietly and watch for a few minutes
- Knows the difference between a pet and a wild animal
- Can draw a simple animal and label its parts with help

MASTERY CHECKLIST

- ☐ I can name and draw three backyard birds and tell one field mark for each.
- ☐ I can tell how a mole is built for digging and how a mole is different from a mouse.
- ☐ I can name three night animals and tell why I must never touch or feed them.
- ☐ I can tell two ways to keep pets and chickens safe from coyotes and foxes.
- ☐ I can keep a wildlife-watching log with dates, times and what I saw.

LESSONS IN THIS UNIT

2.1 Backyard Birds and Feeders

2 sessions of 30–40 minutes

2.2 Mice and Moles Underground

2 sessions of 30–40 minutes

2.3 Raccoons, Opossums and Skunks

2 sessions of 30–40 minutes

2.4 Coyotes and Foxes: Keeping Pets and Hens Safe

2 sessions of 30–40 minutes

UNIT 2 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing to pictures, or drawing. There are no points; listen for understanding and for the safety rules.

1. Point to or draw a cardinal, a blue jay and a chickadee. Tell one field mark for each.
2. How is a mole built for digging?
3. What does nocturnal mean? Name two nocturnal animals.
4. You see a raccoon walking in circles in the middle of the day. What do you do?
5. How can a family keep their hens safe from foxes and raccoons at night?
6. Show me what you do if you see a coyote.

ANSWER KEY

1. Cardinal: red (male), crest, thick beak, black face. Blue jay: blue, white and black, crest. Chickadee: small, black cap and bib, white cheeks.
2. Big shovel-like front paws turned out to the side, strong claws, velvety fur, tiny eyes and no outer ears.
3. Active at night and resting in the day. Raccoon, opossum, skunk (also owls, foxes, coyotes).
4. Stay away, go inside, and tell a grown-up right away. It may be sick; never touch or feed it.
5. Shut the hens in the coop every evening, use strong hardware cloth with an apron on the ground, and use latches raccoons cannot open.
6. Do not run. Stand tall, wave arms, speak loudly and firmly, and back away slowly toward a grown-up or inside.

PORTFOLIO PIECE: MY BACKYARD WILDLIFE JOURNAL

Make a small wildlife journal or poster of the animals that live near your home. Include your bird feeder log, drawings of at least three birds and two mammals, any tracks or signs you found with dates, and a safety page with the never-touch rule and the coyote steps.

LOOK FOR	WHAT IT MEANS
Careful watching	Kept the feeder log for at least a week with dates and times.
Drawing and labeling	Drew at least five animals with their field marks or body parts labeled.
Signs and tracks	Looked for and recorded at least one animal sign or track.
Safety	Can explain, without help, why we never touch or feed wild animals and what to do if one acts strange.

2.1 BACKYARD BIRDS AND FEEDERS

OBJECTIVES

- Identify three to five common backyard birds by color, size, shape and markings.
- Tell which foods different birds like.
- Make a simple bird feeder and keep a feeder-watching log.

Warm-up. Sit by a window for three minutes, very still. Count every bird you see. Is it big or small? What color? Is it on the ground, in a tree or on a feeder? Make a tally mark for each bird.

WATCH

Make Your Own Recycled Bird Feeders - #sciencegoals

SciShow Kids · 4:04

<https://www.youtube.com/watch?v=sKlyeeCBL-w>

WHEN TO WATCH

Before the hands-on project. Notice which foods birds eat and which feeders the children make.

BACKUP VIDEO

Top 5 Feeder Birds of Eastern North America (with LesleytheBirdNerd)

Badgerland Birding · 6:37

<https://www.youtube.com/watch?v=3x9gFiuRW38>

After the core ideas. Pause on each bird and say its field marks before the narrator does.

KEY TERMS

field mark

A special color, stripe or spot that helps you tell which bird it is, like the black cap of a chickadee.

beak

A bird's hard mouth. Its shape shows what the bird eats.

feeder

A tray, tube or hanging holder that offers seed or suet to birds.

binoculars

A tool with two lenses that makes faraway things look close.

CORE IDEAS

Many birds visit our yards every day. Some of the most common in much of the United States are the **northern cardinal** (the male is bright red with a crest and a black face), the **blue jay** (blue, white and black, with a crest and a loud call), the **black-capped chickadee** (small, with a black cap and bib and white cheeks), the **mourning dove** (soft tan-gray, with a small head and a cooing song), and the **American robin** (gray-brown back and orange-red breast).

To name a bird, look for its **field marks**. Ask: How big is it, compared to a sparrow, a robin or a crow? What colors are on its head, wings and breast? Does it have a crest, stripes or spots? What shape is its beak? Where is it: on the ground, on a trunk, or at the feeder?

A bird's beak tells what it eats. Cardinals and finches have thick, strong beaks for cracking seeds. Robins have thin beaks for pulling up worms and eating berries. Woodpeckers have strong, pointed beaks for drilling into wood to find insects.

Feeding birds lets us watch them closely. Black-oil sunflower seed is a favorite of many birds. Suet (hard fat) feeds woodpeckers and nuthatches in cold weather. Fresh water in a shallow birdbath helps birds all year.

A good feeder is kept clean. Wet, moldy seed can make birds sick, so throw out old seed, scrub the feeder every couple of weeks with a grown-up, and wash your hands after you fill it. Place feeders either very close to a window or far from it, so birds do not fly into the glass.

Jesus said that our heavenly Father feeds the birds. When we fill a feeder, we can remember that God cares for each sparrow, and even more for us.

PICTURE STUDY



Cardinal Grosbeak (Northern Cardinal), John James Audubon (engraved by Robert Havell), 1833 · Hand-colored engraving from *The Birds of America* · National Gallery of Art, Washington

Image: [Wikimedia Commons](#), public domain

John James Audubon traveled through the woods and swamps of early America to paint every bird he could find, life-sized. This picture shows a pair of cardinals, which Audubon called cardinal grosbeaks. You may see the very same birds at your feeder.

Look closely

- Find the male and the female. How are they different in color? Which one would be easier for a hawk to spot?
- Look at the beaks. Are they thin or thick? What does that tell you about what cardinals eat?
- Find the crest, the pointed tuft of feathers on top of the head.
- Find the black feathers around the male's beak. That is a field mark.

Talk about it

1. If you saw a brown bird with a red beak and a crest at your feeder, what bird might it be?
2. Why do you think Audubon painted the birds life-sized?
3. What other bird has a crest like the cardinal?

Safety first. Wash your hands with soap after filling or cleaning a feeder, and after touching anything birds have touched. Never pick up a bird, a nest or a feather from a sick-looking bird; tell a grown-up instead.

HANDS-ON PROJECT

A Pinecone or Milk-Carton Feeder and a Feeder Log

You will make a bird feeder, hang it where you can see it from a window, and keep a log of the birds that come.

You will need

- A large pinecone and string, or a clean half-gallon milk carton or plastic bottle (a grown-up cuts a window in it)
- Plain vegetable shortening or sunflower-seed butter (avoid peanut butter if anyone has an allergy)
- Black-oil sunflower seed or mixed birdseed
- A butter knife or spoon
- A bird guide book or a printed list of local feeder birds
- Binoculars (optional)

Steps

1. Pinecone feeder: tie a long string to the top of the pinecone first. Spread shortening into the cracks with a butter knife, then roll the cone in birdseed.
2. Carton feeder: a grown-up cuts a window on two sides of the carton, about two inches from the bottom, and pokes a hole near the bottom for a stick perch. Fill the bottom with seed.
3. Hang the feeder on a branch or hook where you can see it from a window, and where cats cannot hide underneath to pounce.
4. Wait. Birds may take a few days to find a new feeder.
5. Make a log page with columns: date, time, weather, bird, how many, what it did.
6. Watch for ten minutes at the same time each day for a week. Fill in your log.
7. Do a timed bird tally: set a timer for 15 minutes and watch your feeder or yard. Make a tally mark for each bird of each kind, counting the most of one kind you see at one time so you do not count the same bird twice. Write the total for each kind and the date, time and weather.

8. Use your bird guide to name each bird. If you do not know a bird, draw it and write its field marks.

Tips

- Birds are busiest in the early morning.
- Move slowly near the window. Sudden motion scares birds away.
- Families can share their counts with real scientists: the Great Backyard Bird Count runs February 12–15, 2027, and Project FeederWatch runs from November to April. A 15-minute tally is all it takes to take part.

Check your work

- ☐ I can name at least three birds that came to my feeder.
- ☐ I wrote the date and time each time I watched.
- ☐ I washed my hands after filling the feeder.

NATURE JOURNAL

1. Draw one bird from your feeder as carefully as you can. Label its beak, crest (if it has one), wings, tail and feet, and color it.
2. Draw three beak shapes: a seed-cracker, a worm-catcher and a wood-driller. Write what each one eats.
3. Keep your feeder log for a week. At the end, write which bird came the most.

From history. John James Audubon spent many years painting the birds of America. His great book, *The Birds of America*, was finished in 1838 and showed 435 life-sized pictures. Each page was so big that some birds were painted bending over to fit.

COMMON MISTAKES

- Letting old seed get wet and moldy in the feeder. Fill it with only what the birds will eat in a few days.
- Guessing a bird's name too fast. Look at size, color, shape and beak first.

Make it a game • Feeder Bird Field Marks. Draw three backyard birds from memory without looking at a book. Add the color, size, shape and markings you remember. Your grown-up guesses which bird each is, and which food it prefers. Then open the book and check your drawings. Give yourself a point for each field mark you got right.

Scripture. “Behold the fowls of the air: for they sow not, neither do they reap, nor gather into barns; yet your heavenly Father feedeth them. Are ye not much better than they?” (Matthew 6:26, KJV)

Birds do not plant gardens, but God feeds them every day. When we watch the birds at a feeder, we remember that God takes care of us too.

2.2 MICE AND MOLES UNDERGROUND

OBJECTIVES

- Tell how a mole's body is built for digging.
- Tell how moles and mice are different in what they eat and where they live.
- Find signs of animals that live under the ground.

Warm-up. Feel your own hands and then look at a picture of a mole's front feet. Pretend to dig through soil with your hands like a mole: push the dirt to the sides, not down. Is it hard work?

WATCH

What's It Like to Live Underground?

SciShow Kids · 5:50

<https://www.youtube.com/watch?v=LoEqmnNI3AI>

WHEN TO WATCH

After the warm-up. Pause on the mole and name the parts of its body that help it dig.

BACKUP VIDEO

Ask a Naturalist: How Do Moles Tunnel?

Genesee County Parks · 3:11

https://www.youtube.com/watch?v=CF_VQjZWPe4

For more about mole tunnels, after the core ideas.

KEY TERMS

mole

A small digging animal with velvety fur, huge front paws, tiny eyes and no outer ears. It eats earthworms and grubs.

mouse

A small animal with big ears, big eyes and a long tail. It eats seeds, grains and insects.

tunnel

An underground path. Moles push up raised ridges in the lawn when they tunnel near the surface.

molehill

A little mound of loose soil a mole pushes up from a deep tunnel.

grub

The fat, white young form of a beetle that lives in the soil.

CORE IDEAS

A whole world of animals lives under the lawn and the garden. Two of them are often mixed up: moles and mice.

A **mole** is built for digging. Its front feet are wide like shovels, with strong claws, and they turn out to the sides so it can swim through the soil. Its fur is short and velvety and can lie forward or backward, so it can go either way in a tunnel. Its eyes are tiny and it has no outer ears to get clogged with dirt. It finds food with its sensitive nose and whiskers.

Moles do not eat garden plants. They eat **earthworms**, **grubs** and insects. A mole is so busy that it must eat a lot every day. As it hunts, it pushes up soft ridges and little **molehills** in the lawn. Gardeners do not like the bumps, but moles also loosen the soil and eat grubs that harm grass roots.

A **mouse** is different. It has big ears, big dark eyes and a long tail. Mice eat seeds, grain, fruit, roots and insects. Field mice and deer mice make nests in tall grass, under logs or in burrows. In fall, some try to come into garages and houses to stay warm.

God fitted each creature to its home. The mole's shovel paws and the mouse's quick feet and sharp ears are just right for the lives they live.

We do not touch wild mice. They can carry germs in their droppings. If you find droppings or a nest in a shed or garage, tell a grown-up and do not sweep or touch it yourself.

PICTURE STUDY



Common American Shrew Mole, John James Audubon and John Woodhouse Audubon, 1845–1848 ·
Hand-colored lithograph from *The Viviparous Quadrupeds of North America · The Viviparous Quadrupeds of North America*

Image: [Wikimedia Commons](#), public domain

After painting the birds of America, Audubon and his sons set out to paint all of America's furry animals. This plate shows the eastern mole, the very mole that pushes up ridges in lawns across much of the country.

Look closely

- Find the mole's front paws. What do they look like? How are they turned?
- Look for the eyes and ears. Can you find them at all?
- Look at the nose. What shape is it? How might a mole use it underground?
- Look at the field and the farmhouse behind the moles. Where might the mole's tunnels be?

Talk about it

1. Why would big eyes and ears be a problem for an animal that lives in a tunnel?
2. How is a mole's body different from a mouse's body?
3. A mole eats earthworms and grubs. Why might a gardener be glad to have one, and why might he not?

Safety first. Never touch a wild mouse, mole or its droppings or nest. Tell a grown-up if you find one. Wash your hands after working outdoors in the soil.

HANDS-ON PROJECT

Underground Detective and a Mole Tunnel Model

You will look for signs of underground animals in your yard or a park, and then build a model that shows a mole's tunnel world.

You will need

- A clear plastic box, a large jar, or a shoebox with one side cut out and covered with plastic wrap
- Soil or potting mix
- Small stones, a few dry leaves and grass
- Modeling clay
- A pencil or straw
- A small flag or craft stick to mark tunnels outdoors

Steps

1. Go on a walk around the yard or a park with a grown-up. Look for raised ridges in the grass, small cone-shaped mounds of loose soil, or little round holes near logs and walls.
2. When you find a sign, mark it with a flag and draw it in your journal. Do not dig into it.
3. Back inside, fill your clear box with soil, packing it a little firm.
4. Press a pencil or straw sideways along the glass or plastic to make tunnels you can see. Make a long feeding tunnel near the top and a deeper tunnel below.
5. Make a little nest chamber at the end of the deep tunnel and line it with dry grass.
6. Shape a mole from clay with big front paws and a pointed nose. Put it in a tunnel. Add clay earthworms in the soil around it.
7. Push a little soil up on top to make a molehill above one tunnel. Explain your model to someone.

Tips

- Raised ridges are shallow feeding tunnels. Cone-shaped molehills come from deeper tunnels.
- Small round holes about an inch wide, near cover, are often made by mice or voles.

Check your work

- ☐ I found or looked for at least one underground animal sign.
- ☐ My model shows a tunnel, a molehill and a nest.
- ☐ I can tell two ways a mole is built for digging.

NATURE JOURNAL

1. Draw a mole and a mouse side by side. Label the paws, eyes, ears, nose and tail of each.
2. Draw a cut-away picture of the ground showing grass on top and a mole tunnel, worms and a nest below.
3. Record any animal signs you found: what it looked like, where it was and the date.

COMMON MISTAKES

- Thinking moles eat plant roots and bulbs. Moles eat worms and grubs. Voles and mice are the ones that nibble roots.
- Digging into a burrow to see the animal. Leave burrows alone and watch from a distance.

Make it a game • Mole or Mouse Mystery. Your grown-up reads clues one at a time: I dig with wide front paws, I eat grubs, I live in tunnels. Guess mole or mouse before the third clue for double points. Then switch and you write the clues. Include the part of the body built for digging. Play until one of you reaches ten points.

2.3 RACCOONS, OPOSSUMS AND SKUNKS

OBJECTIVES

- Tell what raccoons, opossums and skunks look like and what they eat.
- Tell that these animals are mostly nocturnal.
- Know and follow the rule: never touch or feed wild animals, and tell an adult about one that acts strange.

Warm-up. Play “Who am I?” The parent gives clues one at a time: “I wear a black mask. I have a ringed tail. My front paws feel like little hands.” (Raccoon.) “I have a long, bare tail and I carry my babies on my back.” (Opossum.) “I have black and white stripes and a very strong smell.” (Skunk.)

WATCH

Raccoons for Kids | Animal Facts & Habitat

Homeschool Pop • 6:24

<https://www.youtube.com/watch?v=qItw5vYJuXU>

WHEN TO WATCH

After the warm-up. Pause after each fact and add it to your animal chart.

BACKUP VIDEO

Mythbusting Opossum Facts | Backyard Nature

Nature on PBS • 3:16

<https://www.youtube.com/watch?v=fLYofE1WFMs>

For the opossum part of the lesson. Watch for how a wildlife filmmaker quietly observes an opossum.

KEY TERMS

nocturnal

Awake and active at night and resting during the day.

omnivore

An animal that eats both plants and animals.

marsupial

An animal whose mother carries her tiny babies in a pouch. The opossum is North America's only marsupial.

rabies

A serious sickness some wild animals can carry and spread by biting. It is why we never touch wild animals.

CORE IDEAS

When we go to bed, some neighbors are just waking up. Raccoons, opossums and skunks are **nocturnal**. They sleep in the day and come out at night to look for food.

The **raccoon** wears a black mask and has a bushy tail with dark rings. Its front paws are very sensitive, almost like hands. Raccoons can open latches, lift lids and turn over trash cans. They eat fruit, nuts, corn, insects, crayfish, eggs and anything left in an open trash can. They are clever climbers.

The **opossum** has a white face, a pink nose, black ears and a long, bare tail. It is a **marsupial**: the mother carries tiny babies in a pouch, and later the young ride on her back. Opossums eat insects, snails, slugs, fallen fruit and many ticks. When scared, an opossum may hiss, or even fall over and lie very still.

The **skunk** is black with white stripes. Its stripes warn other animals to stay away. If it feels in danger, it stamps its feet, raises its tail, and then sprays a terrible-smelling oil. Skunks dig in lawns for grubs and beetles.

All three are **omnivores**, and all three come near houses when they smell food. The best way to keep them away is to put trash in cans with tight lids, bring pet food inside at night, and pick up fallen fruit.

The most important rule: **never touch, chase, corner or feed a wild animal**. Wild animals can bite and can carry **rabies**. A raccoon, skunk or fox that is out in daytime, walks in circles, stumbles, or acts very tame or very angry may be sick. Go inside and tell a grown-up right away.

PICTURE STUDY



Virginian Opossum, John James Audubon and John Woodhouse Audubon, 1845–1848 · Hand-colored lithograph from *The Viviparous Quadrupeds of North America* · *The Viviparous Quadrupeds of North America*

Image: [Wikimedia Commons](#), public domain

Audubon watched opossums in the woods of the South. In this picture a mother opossum and her seven-month-old son climb a persimmon tree, one of the opossum's favorite fall foods. Look closely at how they are built for climbing.

Look closely

- Find the two opossums. Which one is the grown-up mother and which is her half-grown young one?
- Find a tail. Is it furry or bare? How might an opossum use it on a branch?
- Look at the feet. Can you find a toe that sticks out like a thumb?
- Look at the face: the white fur, the pointed nose and the dark ears.
- Find the round orange fruits. These are persimmons, which ripen in the fall.

Talk about it

1. Why do you think opossums are good climbers?
2. When this young opossum was tiny, where did its mother carry it?
3. If you saw an opossum in your yard, what should you do?

Safety first. Never touch, feed or corner a raccoon, opossum or skunk, even a baby. If a wild animal is out in the daytime and acting strangely, go inside and tell an adult. If a pet is bitten or sprayed, a grown-up should call the vet.

HANDS-ON PROJECT

Night Visitor Detective

You will look for the signs that night animals leave behind, and make a fact chart about raccoons, opossums and skunks.

You will need

- A large sheet of paper divided into three columns
- Colored pencils
- A shallow pan or patch of smooth mud or sand
- A flashlight (for an evening look with a grown-up)
- A trail camera (optional)

Steps

1. Make a three-column chart. At the top, draw a raccoon, an opossum and a skunk.
2. Under each animal, fill in: what it looks like, what it eats, where it sleeps, and how it protects itself.
3. Make a track trap: smooth out a patch of damp sand or mud near a garden edge or path, away from the house door. Do not put food in it.
4. Check the track trap in the morning. Raccoon tracks look like tiny handprints with five long fingers. Opossum back feet have a thumb that points sideways. Skunk tracks show five toes and long front claws.
5. Walk around the yard in the daytime with a grown-up and look for signs: a knocked-over trash can, small cone-shaped holes dug in the lawn (often skunks hunting grubs), or tracks.
6. If you have a trail camera, set it up with a grown-up for a few nights and look at what visits.
7. Write on your chart one thing your family can do to avoid inviting these animals close, such as tight trash lids.

Tips

- Look at tracks early in the morning before they dry out or get stepped on.

- Watch only from a window or with a grown-up. Never try to get close to an animal you see.

Check your work

- ☐ My chart has four facts about each of the three animals.
- ☐ I can say the never-touch rule and why it matters.
- ☐ I looked for at least one sign of a night visitor.

NATURE JOURNAL

1. Draw a raccoon, an opossum and a skunk. Label the mask, the ringed tail, the bare tail and the stripes.
2. Draw any tracks you found, life-sized if you can. Write the date and where you found them.
3. Write or tell three things that might invite night animals to a yard and how to fix each one.

From history. Captain John Smith of Jamestown wrote about the raccoon in 1612. The name comes from a Powhatan word that meant something like “one who scratches with its hands.” The word opossum also comes from the Powhatan language.

COMMON MISTAKES

- Thinking a baby raccoon or opossum alone needs rescuing. Its mother is usually nearby. Leave it and call a wildlife rehabilitator if a grown-up thinks it needs help.
- Leaving pet food or open trash outside overnight. It invites night visitors.

Make it a game • Night Visitor Clue Cards. Write one clue card each for raccoon, opossum and skunk, covering what it looks like, what it eats and that it is nocturnal. Shuffle and read one aloud. Your grown-up guesses and adds one more fact. Keep a distance from any real wild animals and never touch. Rabies is the reason.

2.4 COYOTES AND FOXES: KEEPING PETS AND HENS SAFE

OBJECTIVES

- Tell what red foxes and coyotes look like and how they live.
- Tell that foxes and coyotes are predators that hunt small animals, including chickens and sometimes small pets.
- Name ways families protect pets and hens, and what to do if you see a coyote.

Warm-up. Look at pictures of a dog, a red fox and a coyote. Find three ways they are alike and three ways they are different. (All are in the dog family. Look at size, color, ears, tail and legs.)

WATCH

Fox Facts for Children

Homeschool Pop • 6:14

https://www.youtube.com/watch?v=4_zEiHhvqF0

WHEN TO WATCH

After the warm-up. Pause after each fact and decide whether it is also true of coyotes.

BACKUP VIDEO

Coyote Education for Kids

The Broomfield Channel • 9:40

<https://www.youtube.com/watch?v=ppJN3DpEZW8>

Before the hands-on project. Practice the safety steps along with the children in the video.

KEY TERMS

predator

An animal that hunts and eats other animals.

prey

An animal that is hunted and eaten by another animal.

den

A hidden home, often in a hole or under rocks, where foxes and coyotes raise their young.

coop

A house where chickens sleep and lay eggs, closed up at night to keep them safe.

hardware cloth

Strong wire mesh with small square holes that predators cannot reach or tear through.

CORE IDEAS

Foxes and coyotes belong to the dog family. The **red fox** is about the size of a small dog. It has rusty-red fur, a white chest, black “socks” on its legs, and a big bushy tail with a white tip. The **coyote** is bigger, about the size of a medium dog, with gray-tan fur, a narrow face, tall pointed ears and a bushy tail with a black tip that it holds low when it runs.

Both are **predators**. Their main foods are mice, voles and rabbits, which helps farmers and gardeners. They also eat insects, fruit and berries. Foxes and coyotes are clever and quick. They have sharp hearing: a fox can hear a mouse moving under the snow and pounce right on it.

Foxes and coyotes live in fields, woods and even towns. They raise their pups in a **den** in the spring. They often hunt at dawn, at dusk and at night, but you may see them in the daytime too.

Because they are predators, they will catch and eat chickens and ducks that are left out, and coyotes may go after cats and small dogs. Good animal keepers protect their animals. Chickens go into a **coop** every evening, and the door is shut. The coop and run are covered with strong **hardware cloth**, not thin chicken wire, and the wire is buried or laid out on the ground so diggers cannot get under. Cats stay indoors at night, and small dogs are walked on a leash and watched in the yard.

If you see a coyote, do not run. Stand tall, wave your arms, speak in a loud, firm voice, and back away slowly to a grown-up or inside. Never feed coyotes or foxes. Animals that are fed lose their fear of people.

Jesus called Himself the Good Shepherd, who protects His sheep. When we shut the hens in at night and watch over our pets, we are being faithful shepherds of the animals in our care.

PICTURE STUDY



Prairie Wolf (Coyote), John James Audubon and John Woodhouse Audubon, 1845–1848 · Hand-colored lithograph from *The Viviparous Quadrupeds of North America* · *The Viviparous Quadrupeds of North America*

Image: [Wikimedia Commons](#), public domain

The Audubons called the coyote the “prairie wolf,” because they first saw it on the open prairies of the West. Today coyotes live in almost every state, even near towns. Look closely at how the coyote is built for hearing, running and hunting.

Look closely

- Look at the ears. Are they big or small, pointed or round? Why would a hunter of mice need big ears?
- Find the tails. What color is the tip? (A red fox’s tail tip is white.)
- Look at the long, thin legs. Is this animal built for digging or for running?
- Look at the land around the coyotes. Is it open or full of trees?

Talk about it

1. How is a coyote different from a red fox?
2. What is one thing a family with chickens should do every evening because of coyotes and foxes?
3. Why should we never feed a coyote, even if it looks friendly?

Safety first. Never go near a fox or coyote or its den. If one comes close, stand tall, make noise and back away to an adult. A fox or coyote that acts tame, stumbles or seems sick should be reported to an adult right away.

HANDS-ON PROJECT

A Safe-Night Plan for Pets and Hens

You will design a chicken coop that keeps hens safe at night and make a safety plan for pets. You do not need chickens to do this. You can visit a neighbor's coop or a farm, or design one on paper.

You will need

- Paper and colored pencils
- A cardboard box, craft sticks and a scrap of window screen or mesh for a model (optional)
- Tape and glue
- A ruler

Steps

1. If you can, visit a neighbor, farm or fair that keeps chickens. Look at the coop. Ask how they keep it safe from foxes, raccoons and coyotes.
2. Draw a coop with a run (a fenced yard). Label the roost bars, the nest box, the door and the run.
3. Add the safety features: hardware cloth on all sides and over the top of the run, wire laid flat on the ground around the edges (an apron) so diggers cannot get in, and a strong latch that a raccoon cannot open.
4. Draw a clock showing what time the door gets shut each evening (at dusk, when the hens go in to roost) and opened each morning.
5. If you like, build a model with a cardboard box. Use mesh for the run and craft sticks for the roost.
6. Make a pet-safety list for your family or a neighbor: cats indoors at night, small dogs on a leash and watched, pet food brought inside, trash lids tight.
7. Practice the coyote steps: stand tall, wave your arms, make a loud voice, back away slowly. Do not run.

Tips

- Raccoons can reach through large wire holes and open simple hooks. That is why keepers use small-hole hardware cloth and two-step latches.

- Hens go into the coop on their own at dusk. The keeper's job is to shut the door.

Check your work

- ☐ My coop drawing has at least three safety features labeled.
- ☐ I can say what to do if I see a coyote.
- ☐ I can name two ways to keep a cat or small dog safe.

NATURE JOURNAL

1. Draw a red fox and a coyote side by side. Label the fur color, ears, tail tip and size.
2. Draw a simple food chain: grass, then a mouse, then a fox. Draw arrows to show who eats whom.
3. Write the four coyote-safety steps in your own words.

COMMON MISTAKES

- Using thin chicken wire to keep predators out. It keeps chickens in, but foxes and raccoons can tear or reach through it.
- Running away from a coyote. Running can make it chase. Stand tall and back away slowly.

Make it a game • Safe Night Plan Challenge. You are the hen-and-pet protector. Your grown-up names a danger, like a fox sneaking around the coop at night. Answer fast with a fix: lock the coop, use hardware cloth, bring pets inside. See how many fixes you can give in sixty seconds. Name which animals are predators and which are prey.

Scripture. "I am the good shepherd: the good shepherd giveth his life for the sheep." (John 10:11, KJV)

A good shepherd watches over his flock and keeps it safe from wolves and foxes. Jesus is our Good Shepherd, and we can be faithful keepers of the animals God gives us.

UNIT 2

BACKYARD WILDLIFE

Fall is a busy time for the wild animals that share our yards. In this unit your child learns to recognize common backyard birds and feed them well, discovers the mice and moles that live underground, meets the night visitors (raccoons, opossums and skunks), and learns about coyotes and foxes and how families keep pets and hens safe from them.

Our pictures come from the great American naturalist John James Audubon and his son John Woodhouse Audubon, who painted birds and mammals from life. The most important rule of the whole unit is simple: **look, but do not touch**. We watch wild animals from a safe distance, and we never feed or pet them.

PREREQUISITES

- Can sit quietly and watch for a few minutes
- Knows the difference between a pet and a wild animal
- Can draw a simple animal and label its parts with help

MASTERY CHECKLIST

- ☐ I can name and draw three backyard birds and tell one field mark for each.
- ☐ I can tell how a mole is built for digging and how a mole is different from a mouse.
- ☐ I can name three night animals and tell why I must never touch or feed them.
- ☐ I can tell two ways to keep pets and chickens safe from coyotes and foxes.
- ☐ I can keep a wildlife-watching log with dates, times and what I saw.

LESSONS IN THIS UNIT

2.1 Backyard Birds and Feeders

2 sessions of 30–40 minutes

2.2 Mice and Moles Underground

2 sessions of 30–40 minutes

2.3 Raccoons, Opossums and Skunks

2 sessions of 30–40 minutes

2.4 Coyotes and Foxes: Keeping Pets and Hens Safe

2 sessions of 30–40 minutes

UNIT 2 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing to pictures, or drawing. There are no points; listen for understanding and for the safety rules.

1. Point to or draw a cardinal, a blue jay and a chickadee. Tell one field mark for each.
2. How is a mole built for digging?
3. What does nocturnal mean? Name two nocturnal animals.
4. You see a raccoon walking in circles in the middle of the day. What do you do?
5. How can a family keep their hens safe from foxes and raccoons at night?
6. Show me what you do if you see a coyote.

ANSWER KEY

1. Cardinal: red (male), crest, thick beak, black face. Blue jay: blue, white and black, crest. Chickadee: small, black cap and bib, white cheeks.
2. Big shovel-like front paws turned out to the side, strong claws, velvety fur, tiny eyes and no outer ears.
3. Active at night and resting in the day. Raccoon, opossum, skunk (also owls, foxes, coyotes).
4. Stay away, go inside, and tell a grown-up right away. It may be sick; never touch or feed it.
5. Shut the hens in the coop every evening, use strong hardware cloth with an apron on the ground, and use latches raccoons cannot open.
6. Do not run. Stand tall, wave arms, speak loudly and firmly, and back away slowly toward a grown-up or inside.

PORTFOLIO PIECE: MY BACKYARD WILDLIFE JOURNAL

Make a small wildlife journal or poster of the animals that live near your home. Include your bird feeder log, drawings of at least three birds and two mammals, any tracks or signs you found with dates, and a safety page with the never-touch rule and the coyote steps.

LOOK FOR	WHAT IT MEANS
Careful watching	Kept the feeder log for at least a week with dates and times.
Drawing and labeling	Drew at least five animals with their field marks or body parts labeled.
Signs and tracks	Looked for and recorded at least one animal sign or track.
Safety	Can explain, without help, why we never touch or feed wild animals and what to do if one acts strange.

UNIT 3

SOIL

Soil is not just dirt. It is a mix of tiny bits of rock, water, air, and once-living things, and it is full of life. In this unit your child learns to tell sand, silt and clay apart by feel, discovers the dark, rich humus that makes soil good for growing, builds a compost pile from “browns” and “greens,” and sets up a worm bin that turns kitchen scraps into the best soil of all.

The pictures we study show people working the soil: a digging peasant woman by Vincent van Gogh, Albrecht Dürer’s tiny patch of grassy field, and two pictures by Jean-François Millet, who grew up on a farm and painted farm work with great respect. The projects are hands-on and a little messy. Keep gloves, an old tablecloth and soap close by.

PREREQUISITES

- Knows that plants grow in soil
- Can use a magnifying glass
- Is willing to get hands dirty (with gloves if preferred)

MASTERY CHECKLIST

- ☐ I can tell sand, silt and clay apart by how they feel.
- ☐ I can explain that humus is made from dead leaves and plants that have rotted.
- ☐ I can sort compost materials into browns and greens.
- ☐ I can tell what red worms need to live and what they make.
- ☐ I can tell why good soil matters to gardeners and farmers.

LESSONS IN THIS UNIT

3.1 Sand, Silt and Clay

2 sessions of 30–40 minutes

3.2 Humus: The Dark, Rich Part of Soil

2 sessions of 30–40 minutes

3.3 A Compost Pile: Browns and Greens

2 sessions of 30–40 minutes

3.4 A Worm Bin

2 sessions of 30–40 minutes

UNIT 3 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing, or showing with real soil. There are no points; listen for understanding.

1. Here are three samples. Use your fingers to tell me which is sand, which is like silt and which is clay.
2. What is humus, and how is it made?
3. Sort these into browns and greens: dry leaves, banana peel, newspaper, grass clippings, straw, coffee grounds.
4. Name two things that should never go in a home compost pile, and tell why.
5. What do red worms need to live in a bin?
6. Why is a gardener happy to find lots of worms in the soil?

ANSWER KEY

1. Sand is gritty, silt is smooth and silky like flour, clay is sticky when wet and makes a long ribbon.
2. Dark, crumbly soil made when dead leaves, plants and animals rot and are broken down by decomposers.
3. Browns: dry leaves, newspaper, straw. Greens: banana peel, grass clippings, coffee grounds.
4. Any two: meat, bones, fish, dairy, oily food, pet droppings. They smell, attract animals and can carry germs.
5. Damp bedding, air, darkness, the right temperature, and small amounts of fruit and vegetable scraps.
6. Worms make rich castings, mix humus into the soil, and make tunnels that let in air and water.

PORTFOLIO PIECE: MY LIVING SOIL REPORT

Make a soil report to show your family. Include your taped soil samples with ribbon-test results, your forest-floor layers drawing, a photo or drawing of your compost pile or jar, and your worm log. Finish by showing a handful of finished compost or worm castings (or dark humus from the woods) and telling how it was made.

LOOK FOR	WHAT IT MEANS
Soil textures	Tested at least two soils and can tell sand, silt and clay by feel.
Humus and decomposers	Can explain how leaves become humus and name two decomposers.
Compost	Started a compost pile or jar with browns and greens, and kept a log for at least three weeks.
Worm care	Fed and checked the worms (or the worm jar) faithfully and kept the bedding damp.

3.1 SAND, SILT AND CLAY

OBJECTIVES

- Name the three sizes of rock bits in soil: sand, silt and clay.
- Tell sand, silt and clay apart by how they feel when dry and wet.
- Do a ribbon test on a soil sample from home.

Warm-up. Put a spoonful of sand, a spoonful of flour (it feels like silt) and a small lump of modeling clay on a plate. Close your eyes and rub each one between your fingers. Describe each with one word: gritty, silky or sticky.

WATCH

Why Different Soils Feel Different

[SciShow Kids](https://www.youtube.com/watch?v=qJ9fJU1X9mA) · 6:51

<https://www.youtube.com/watch?v=qJ9fJU1X9mA>

WHEN TO WATCH

After the warm-up. Pause when the jars of soil and water are shown and guess which soil will let the water through fastest.

BACKUP VIDEO

Eye on Agriculture Today: Soil Texture By Feel

[K-State Extension](https://www.youtube.com/watch?v=lOyaBxj767s) · 6:09

<https://www.youtube.com/watch?v=lOyaBxj767s>

Before the ribbon test. Watch how the soil scientist wets the soil and squeezes it into a ribbon.

KEY TERMS

sand

The biggest bits of rock in soil. Sand feels gritty and lets water run through fast.

silt

Middle-sized bits of rock, as fine as flour. Silt feels smooth and silky.

clay

The tiniest bits of rock. Clay feels sticky when wet, holds water, and gets hard when dry.

loam

A mix of sand, silt and clay with plenty of humus. Most plants grow best in loam.

texture

How something feels. Soil texture tells how much sand, silt and clay it has.

CORE IDEAS

Soil is made partly of tiny bits of rock. Over a long time, wind, water, ice and plant roots crack rocks into smaller and smaller pieces. These pieces come in three main sizes.

Sand is the biggest. You can see each grain. It feels gritty, like sugar. Water runs right through sandy soil, so it dries out fast and does not hold much food for plants.

Silt is middle-sized, like flour. It feels smooth and silky when dry and a little slippery when wet. **Clay** is the smallest, far too small to see one piece. Wet clay feels sticky and can be squeezed into a long ribbon. Clay holds lots of water and plant food, but it can get soggy, and it cracks hard as a brick when it dries.

Most garden soil is a mix of all three. A good mix with lots of dark, rotted plant matter is called **loam**. Loam crumbles in your hand like chocolate cake. It holds enough water, but not too much, and plant roots can push through it easily.

Gardeners test their soil by feel. Wet a spoonful, squeeze it, and push it out between your thumb and finger. If it falls apart and feels gritty, it is sandy. If it makes a long, shiny ribbon, it has lots of clay. If it feels smooth and makes a short ribbon, it is silty or loamy.

God made the ground for growing things. Knowing your soil helps you care for the plants you put in it.

PICTURE STUDY



Peasant Woman Digging, Vincent van Gogh, 1885 · Oil on canvas

Image: [Wikimedia Commons](#), public domain

Before he painted sunflowers and starry nights, Vincent van Gogh lived among poor Dutch farmers and painted them at work. Here a woman is turning over the soil with a spade to get it ready for planting. Look at how heavy the soil seems.

Look closely

- Find the spade. How is she using her foot and her arms?
- Look at the color of the soil. Is it pale like sand or dark and heavy?
- Look at her back and shoulders. Is digging easy or hard work here?
- Can you see clods, or lumps, of soil?

Talk about it

1. Do you think this soil is sandy or full of clay? What clues tell you?
2. Why do farmers turn over the soil before planting?
3. Van Gogh once wanted to be a pastor. Why do you think he wanted to paint hard-working farmers?

Safety first. Wear gloves if you have a cut on your hands, and wash with soap after handling soil. Do not put soil near your mouth or eyes.

The Squeeze-and-Ribbon Soil Test

You will collect soil from two or three places and test each one by feel to find out whether it is sandy, silty or full of clay.

You will need

- Three small cups or bags
- A trowel or old spoon
- Soil from two or three different spots (garden bed, under a tree, a sandbox or a bag of potting mix)
- A spray bottle of water
- Paper plates
- A magnifying glass
- Labels and a marker

Steps

1. With a grown-up, dig a spoonful of soil from each spot, a few inches down. Put each in its own cup and label where it came from.
2. Pour a little of each soil onto a paper plate. Look closely with the magnifying glass. Can you see sand grains? Bits of roots or leaves? Any tiny creatures?
3. Rub some dry soil between your fingers. Is it gritty, silky or lumpy and hard?
4. Take a walnut-sized lump and spray it with water until it feels like soft play dough.
5. Squeeze it in your fist. Open your hand. Does it hold together or crumble apart?
6. Push the ball out between your thumb and pointer finger to make a flat ribbon hanging down. Measure how long the ribbon grows before it breaks.
7. Record your results: no ribbon and gritty means sandy; a short ribbon and smooth means silty or loamy; a long ribbon (more than 2 inches) and sticky means lots of clay.

Tips

- Add water slowly. Too much water makes any soil sloppy.
- Bagged potting mix is mostly peat or bark, not sand, silt and clay, so it will not make a ribbon. That is a good comparison.

Check your work

- ☐ I can tell sand, silt and clay apart by feel.
- ☐ I tested at least two soils and recorded my results.
- ☐ I washed my hands when I was done.

NATURE JOURNAL

1. Draw three circles: a big one for sand, a medium one for silt and a tiny dot for clay. Label each and write one word for how it feels.
2. Tape a pinch of each soil sample into your journal (cover it with clear tape). Write where it came from and what your ribbon test showed.
3. Draw a ribbon of soil hanging from fingers. Write how long it was.
4. Make a simple soil poster: a big title, three small jars or drawings of sand, silt and clay, and one sentence on why we care for soil. Practice like this prepares you for the conservation district poster contest open to students from kindergarten to grade 12; check with your local conservation district.

COMMON MISTAKES

- Making the soil too wet. Add water a little at a time.
- Thinking all soil is the same. Even two spots in one yard can be very different.

Make it a game • Blindfold Soil Feel. Close your eyes. Your grown-up puts a pinch of sand, silt or clay, dry or damp, on your palm. Rub it and name the soil bit, and say whether it feels gritty, smooth like flour or sticky. Three right answers earns the title of Loam Master. Trade places and try to trick your grown-up.

3.2 HUMUS: THE DARK, RICH PART OF SOIL

OBJECTIVES

- Tell that humus is dark, crumbly matter made from rotted plants and animals.
- Name decomposers that turn dead leaves into humus.
- Compare soil with lots of humus to soil with little humus.

Warm-up. Go outside and pick up three leaves from the ground: one freshly fallen, one brown and dry, and one old, soft and full of holes. Line them up from newest to oldest. What is happening to the old leaf?

WATCH

Soil Is Alive! | SciShow Kids

SciShow Kids · 6:45

<https://www.youtube.com/watch?v=Q-J2FErZHuA>

WHEN TO WATCH

After the warm-up. Pause on “organic matter” and “decomposers” and say what each word means.

BACKUP VIDEO

What's the Dirt on ... Dirt?

SciShow Kids · 3:43

<https://www.youtube.com/watch?v=if29mjcd5bc>

For review: the four things soil is made of (minerals, water, air and organic matter).

KEY TERMS

humus

The dark, crumbly part of soil made from plants and animals that have rotted away. It feeds plants and holds water like a sponge.

organic matter

Anything that was once alive, like leaves, roots, grass and manure.

decompose

To rot and break down into tiny pieces.

decomposer

A living thing that breaks down dead plants and animals, such as worms, beetles, fungi and bacteria.

CORE IDEAS

In the woods, leaves fall every autumn, but the forest floor does not fill up with leaves. Where do they go? They are eaten and broken down by tiny living things, until they become part of the soil.

Leaves, grass, roots and anything else that was once alive is called **organic matter**. When organic matter rots, or **decomposes**, it turns into a dark, crumbly, sweet-smelling material called **humus** (say HYOO-mus).

The workers that make humus are called **decomposers**. Earthworms, sow bugs, millipedes and beetles chew leaves into small bits. Fungi spread thin white threads through the leaves. Bacteria, far too small to see, finish the job. A single spoonful of good soil holds more tiny living things than there are people on the earth.

Humus is a gift to plants. It holds water like a sponge, so roots do not dry out. It holds plant food and lets it out slowly. It makes sandy soil hold more water and clay soil looser and crumblier. Soil with lots of humus is dark brown or almost black.

Nothing is wasted in God's design. Last year's leaves become this year's soil, and this year's soil grows next year's food. Gardeners copy this by adding leaves and compost to their beds.

PICTURE STUDY



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

Image: [Wikimedia Commons](#), public domain

Five hundred years ago, the German artist Albrecht Dürer knelt down and painted a little square of a grassy field exactly as he saw it, blade by blade. Most painters ignored weeds and grass. Dürer saw that even a clump of turf was worth looking at closely.

Look closely

- Look at the very bottom. Find the dark, wet soil the plants grow from.
- Find the dandelion leaves and the tall grass stems with seed heads.
- Look for any brown or dying leaves. What will happen to them?
- How many different kinds of plants can you count?

Talk about it

1. Where do you think the dark soil at the bottom came from?
2. What would happen to this clump of turf if no leaves or stems ever rotted?
3. Why do you think Dürer painted something as ordinary as grass?

Safety first. Wear gloves when digging through leaf litter, and wash your hands afterward. Look but do not touch if you find a mushroom.

HANDS-ON PROJECT

The Leaf-to-Soil Hunt and the Squeeze Test

You will dig down through the leaves under a tree to see each step of leaves turning into humus, and compare dark soil with pale soil.

You will need

- Garden gloves
- A trowel
- A white paper plate or tray
- A magnifying glass
- Two clear cups with holes poked in the bottom
- A measuring cup of water
- Dark soil from under trees and pale soil from a bare spot or sandbox

Steps

1. Find a spot under trees or bushes where leaves have piled up. Put on gloves.
2. Gently lift the top layer of leaves onto your tray. These are whole and fresh.
3. Dig a little deeper. Find leaves that are broken, soft and full of holes. Look for decomposers: worms, sow bugs, millipedes and white fungus threads.
4. Dig deeper still, to the dark crumbly layer. Smell it. That rich, earthy smell is humus. Put the creatures back where you found them.
5. Back at the table, fill one cup with dark soil and one with pale soil. Hold each over a bowl and pour in the same amount of water.
6. Watch which one drips through faster and which one holds more water. Humus holds water like a sponge.
7. Squeeze a handful of each soil. Which one crumbles nicely? Which one packs hard or falls apart?

Tips

- The best place to find humus is the edge of a woods or under an old hedge.
- If it is winter, lift a log or a board that has been lying on the ground for a while.

Check your work

- ☐ I found leaves at three stages of rotting.
- ☐ I can name two decomposers.
- ☐ I can tell why humus is good for plants.

NATURE JOURNAL

1. Draw a cut-away of the forest floor in three layers: whole leaves on top, broken leaves in the middle, dark humus at the bottom. Label each layer.
2. Draw two decomposers you found, using your magnifying glass.
3. Write which soil held more water in your test and why.

COMMON MISTAKES

- Thinking dead leaves are trash. They are food for the soil.
- Keeping the creatures you find. Put them back where you found them so they can keep working.

Make it a game • Humus Detective Pairs. Make eight small cards, four with decomposers like worms, fungi, bacteria and roly-polies, and four with things they turn into humus. Lay them face down and play memory, matching each helper to what it breaks down. Say what humus feels like when you match a pair: dark and crumbly.

Scripture. “O LORD, how manifold are thy works! in wisdom hast thou made them all: the earth is full of thy riches.” (Psalms 104:24, KJV)

Even the worms and fungi in the soil show God’s wisdom. The earth really is full of His riches, right under our feet.

3.3 A COMPOST PILE: BROWNS AND GREENS

OBJECTIVES

- Sort compost materials into browns and greens.
- Name the four things a compost pile needs: browns, greens, water and air.
- Start a small compost pile or compost jar.

Warm-up. Put a pile of clean kitchen and yard scraps on a tray: dry leaves, a banana peel, newspaper, grass clippings, coffee grounds, a twig, apple cores, and also a few things that do not belong (a plastic fork, a meat bone, a piece of cheese). Sort them into “can compost” and “cannot compost.”

WATCH

How To Make Compost - Fast and Easy

GrowVeg · 9:29

https://www.youtube.com/watch?v=_K25WjjCBuw

WHEN TO WATCH

After the core ideas. Pause when the gardener shows the greens and the browns and name each item.

BACKUP VIDEO

Make the Most of Compost!

SciShow Kids · 5:20

<https://www.youtube.com/watch?v=Q5s4n9r-JGU>

Before the core ideas, as a short introduction to compost and decomposers.

KEY TERMS

compost

Dark, crumbly humus that gardeners make on purpose by letting plant scraps rot in a pile.

greens

Wet, fresh compost materials such as fruit and vegetable scraps, grass clippings and coffee grounds. They are rich in nitrogen.

browns

Dry, dead compost materials such as fallen leaves, straw, shredded paper and cardboard. They are rich in carbon.

turn

To mix a compost pile with a fork or shovel so air gets inside.

CORE IDEAS

In the woods, humus forms slowly as leaves fall and rot. Gardeners speed this up by making a **compost** pile. In a few months, scraps that would have been thrown away become rich, dark compost to feed the garden.

A compost pile needs four things. **Greens** are fresh, wet things like vegetable peels, fruit cores, grass clippings, coffee grounds and old garden plants. **Browns** are dry, dead things like fallen leaves, straw, shredded paper and cardboard. It also needs **water**, enough to be damp like a wrung-out sponge, and **air**.

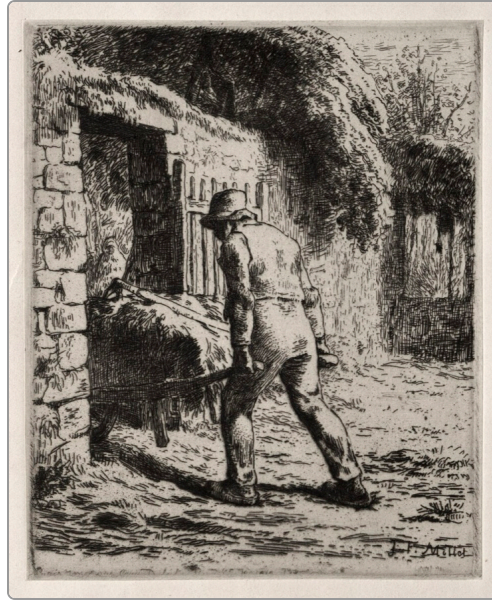
A good rule is to add about two or three buckets of browns for every bucket of greens. Too many greens make a slimy, smelly pile. Too many browns make a pile that sits there and does nothing.

Inside a busy pile, bacteria and fungi eat and multiply so fast that the middle gets hot, sometimes hot enough to steam on a cold morning. Later, worms, sow bugs and beetles move in. **Turning** the pile with a fork every week or two gives the workers fresh air and speeds things up.

Some things do not belong in a home compost pile: meat, bones, fish, cheese, milk, oily foods and pet droppings. They smell bad, attract raccoons and rats, and can carry germs.

When the compost is dark, crumbly and smells like the forest floor, it is done. Gardeners spread it on their beds or mix it into potting soil. The Bible tells of a gardener who wanted to dig around a fig tree and feed it so it would bear fruit. Good gardeners have always fed their soil.

PICTURE STUDY



Peasant Returning from the Manure Heap, Jean-François Millet, about 1855 · Etching · Cleveland Museum of Art

Image: [Wikimedia Commons](#), public domain

Jean-François Millet grew up on a farm in France and drew the hard, honest work of country people. Here a farmer has just carried a load of manure and old straw to the heap. Farmers piled manure to rot, just like compost, and then spread it on the fields to feed the soil.

Look closely

- Find the wheelbarrow. Is it full or empty now?
- Find the stone barn. Where do you think the manure heap is?
- Look at how the farmer leans into his work. Is this easy or heavy work?
- Look at the plants growing over the roof and walls.

Talk about it

1. Why would a farmer save manure and old straw in a heap instead of throwing it away?
2. How is a manure heap like a compost pile?
3. What will the farmer do with the rotted manure later?

Safety first. Wear gloves when handling compost and wash your hands well afterward. Never add meat, bones, dairy or pet droppings. A grown-up handles the pitchfork.

HANDS-ON PROJECT

Start a Compost Pile (or a Compost Jar)

You will start a small compost pile outdoors, or, if you have no yard, a compost jar you can watch through the glass.

You will need

- Outdoor pile: a corner of the yard, a wire ring, or a plastic bin with holes
- Browns: dry leaves, straw, shredded newspaper or torn cardboard
- Greens: fruit and vegetable scraps, coffee grounds, grass clippings
- A bucket for measuring
- Water and a watering can
- Garden gloves and a garden fork (grown-up only)
- Jar version: a large clear jar, soil, scraps, leaves, and a rubber band and cloth for the top
- A thermometer (optional)

Steps

1. Choose a spot that is easy to reach and out of the way. Lay down a layer of twigs or straw to let air in at the bottom.
2. Add a thick layer of browns, about two buckets.
3. Add a layer of greens, about one bucket. Chop big scraps into small pieces so they rot faster.
4. Sprinkle on a handful of garden soil. It carries the bacteria and fungi that start the work.
5. Water the pile until it is damp, not soaking.
6. Keep adding layers, browns then greens, until the pile is at least knee high, or until your bin is full.
7. Jar version: layer soil, leaves and small scraps in a clear jar, dampen it, cover with cloth and a rubber band, and keep it in a shady spot. Mark the top layer with a marker each week.

8. Each week, check that it is damp, and have a grown-up turn it. If you have a thermometer, push it into the middle and record the temperature.

Tips

- If the pile smells bad, add more browns and turn it. If it is dry and nothing happens, add greens and water.
- Keep a small covered bucket by the kitchen sink for scraps.

Check your work

- ☐ I can name three browns and three greens.
- ☐ I can name four things a compost pile needs.
- ☐ I know what must not go in a compost pile.

NATURE JOURNAL

1. Draw your compost pile in layers. Color the browns brown and the greens green, and label each layer.
2. Start a compost log: date, what you added, whether it is damp, and the temperature in the middle.
3. Draw a sign for your kitchen scrap bucket that shows what can and cannot go in.

From history. George Washington loved farming. At his Mount Vernon farm he built a covered “stercorary,” a special shed for storing and mixing manure and compost so the rain would not wash the goodness away. It is one of the earliest known compost buildings in America.

COMMON MISTAKES

- Using only kitchen scraps. Without browns, the pile turns slimy and smelly.
- Letting the pile dry out. The workers inside need moisture.

Make it a game • Compost Pile Builder. Draw a pile with layers. Your grown-up calls out scraps and you shout browns or greens and place each in a layer. Then name the four things a pile needs: browns, greens, water and air. If you can say them all and show how to turn the pile with a pretend fork, the pile heats up.

3.4 A WORM BIN

OBJECTIVES

- Tell how an earthworm's body is made for living in soil.
- Name what red worms need: bedding, moisture, air, darkness and food scraps.
- Set up and care for a worm bin, or observe worms in a jar.

Warm-up. Hold a damp paper towel in one hand and a dry one in the other. Which would a worm rather crawl on? Worms breathe through their skin, which must stay moist. Talk about why worms come up on the sidewalk after a rain.

WATCH

Start A Worm Farm The Right Way: Step By Step Video Guide

Urban Worm Company • 8:30

<https://www.youtube.com/watch?v=ieAbk0VJbWk>

WHEN TO WATCH

Before the hands-on project. Pause after each step (holes, bedding, water, worms, food) and gather that item.

BACKUP VIDEO

Worms Are Wonderful | Amazing Animals | Backyard Science | SciShow Kids

SciShow Kids • 4:34

https://www.youtube.com/watch?v=l-zc_1vjLnI

After the warm-up, to learn how a worm's body works.

KEY TERMS

earthworm

A soft, ringed animal with no legs or bones that lives in soil and eats rotting plants.

castings

Worm droppings. They are a rich, dark plant food.

red wiggler

A small red worm that lives in rotting leaves and compost. It is the best worm for a worm bin.

bedding

Damp shredded paper, cardboard or leaves that worms live in.

vermicompost

Compost made by worms.

CORE IDEAS

Earthworms are some of a gardener's best friends. They have no eyes, no legs and no bones, but God made them perfectly for their work. Their bodies are made of rings, with tiny bristles that grip the soil. They breathe through their moist skin, which is why they hide from the hot sun.

Worms eat rotting leaves, plant scraps and soil. What comes out the other end is called **castings**, and castings are one of the richest plant foods there is. As worms tunnel, they also let air and water down into the soil.

The best worms for a bin are **red wigglers**. They are smaller than the big night crawlers you see after a rain, and they love to live in piles of rotting leaves and compost. You can buy them from a garden store or a worm farm.

A worm bin is a dark box that holds damp **bedding** such as shredded newspaper or cardboard, a handful of soil, the worms, and small amounts of fruit and vegetable scraps. The worms need it damp like a wrung-out sponge, dark, not too hot or cold (about 55 to 80 °F), and with air holes.

Feed worms a little at a time: soft fruit and vegetable peels, coffee grounds, crushed eggshells. Bury the food under the bedding. Do not feed them meat, dairy, oily foods, or very spicy or sour foods like onions and citrus. After a few months, the bedding turns into dark **vermicompost** to feed your plants.

Caring for worms is a small daily faithfulness. Check them, feed them a little, keep them damp, and they will quietly turn scraps into treasure.

PICTURE STUDY



The Diggers, Jean-François Millet, about 1855–1856 · Etching · National Gallery of Art, Washington

Image: [Wikimedia Commons](#), public domain

Millet made this print of two men digging a field together. Before there were tractors, much of the soil in small farms and gardens was turned by hand, one spadeful at a time. Every spadeful of good soil is full of worms.

Look closely

- Find the two diggers. Are they working together or apart?
- Look at how deep the spades go into the ground.
- Look at the turned-over soil behind them. How is it different from the soil in front?
- If you could zoom in on one spadeful, what creatures might you find?

Talk about it

1. Earthworms dig the soil too. How are worms like these diggers?
2. Why would a farmer be happy to see lots of worms when he digs?
3. Which do you think is harder work: digging by hand or caring for a worm bin? Why?

Safety first. Handle worms gently with wet hands, and keep them out of the sun. Wash your hands with soap after touching worms, bedding or castings.

HANDS-ON PROJECT

Set Up a Worm Bin

You will build a home for red wiggler worms and care for them. If you cannot keep worms, make a one-week worm jar with worms from the garden and then return them.

You will need

- A plastic storage tote (about 10 gallons) with a lid, or a store-bought worm bin
- A drill for air holes (grown-up only)
- Newspaper or plain brown cardboard, torn into strips
- A handful of garden soil
- Water in a spray bottle or watering can
- About 1 pound of red wiggler worms
- A few fruit and vegetable scraps, chopped small
- Crushed eggshells
- Jar version: a large clear jar, soil, sand, leaves, a few garden earthworms, and dark paper to wrap it

Steps

1. Have a grown-up drill small air holes in the lid and the upper sides of the tote.
2. Tear newspaper or cardboard into strips about an inch wide. Fill the bin about halfway.
3. Sprinkle water on the bedding and fluff it with your hands until it is damp like a wrung-out sponge. Squeeze a handful: only a drop or two of water should come out.
4. Add a handful of garden soil and some crushed eggshells.
5. Gently set the worms on top. Leave the lid off with a light on for an hour; worms dislike light and will burrow down.
6. Bury a small handful of chopped scraps under the bedding in one corner. Put the lid on and keep the bin in a cool, dark place such as a basement or garage

that does not freeze.

7. Check the bin twice a week. When the food is mostly gone, feed again in a new corner. Add dry bedding if it gets too wet; spray water if it gets dry.
8. Jar version: layer soil, sand and leaves in a jar, add a few earthworms, wrap the jar in dark paper, and peek every day for a week. Then return the worms to the garden.

Tips

- Underfeeding is better than overfeeding. Too much food rots and smells.
- If worms try to crawl out, the bin may be too wet, too dry or too acidic. Add fresh dry bedding and a few eggshells.

Check your work

- ☐ My bedding is damp but not soggy.
- ☐ I can name four things red worms need.
- ☐ I can tell three foods worms can eat and two they should not.

NATURE JOURNAL

1. Draw an earthworm with a magnifying glass. Label its rings, the thick band (called the clitellum) and which end is the head.
2. Keep a worm-bin log: date, what you fed, whether the food was gone, and how damp the bedding was.
3. Draw a worm's-eye view of the bin, showing bedding, food scraps and worms.

COMMON MISTAKES

- Giving the worms too much food at once.
- Using big night crawlers from the yard in a bin. They need deep soil; red wigglers are made for bins.

Make it a game • Worm Bin Rescue. Your worm bin is in trouble. Your grown-up names a problem: too dry, too bright, no food, no air. You give the fix in one sentence and name what red worms need: bedding, moisture, air, darkness and food scraps. Race to solve five problems in a row, no mistakes.

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)

From the very beginning, God gave people the work of caring for the garden. Feeding the soil with compost and worms is part of that good work.

UNIT 3

SOIL

Soil is not just dirt. It is a mix of tiny bits of rock, water, air, and once-living things, and it is full of life. In this unit your child learns to tell sand, silt and clay apart by feel, discovers the dark, rich humus that makes soil good for growing, builds a compost pile from “browns” and “greens,” and sets up a worm bin that turns kitchen scraps into the best soil of all.

The pictures we study show people working the soil: a digging peasant woman by Vincent van Gogh, Albrecht Dürer’s tiny patch of grassy field, and two pictures by Jean-François Millet, who grew up on a farm and painted farm work with great respect. The projects are hands-on and a little messy. Keep gloves, an old tablecloth and soap close by.

PREREQUISITES

- Knows that plants grow in soil
- Can use a magnifying glass
- Is willing to get hands dirty (with gloves if preferred)

MASTERY CHECKLIST

- ☐ I can tell sand, silt and clay apart by how they feel.
- ☐ I can explain that humus is made from dead leaves and plants that have rotted.
- ☐ I can sort compost materials into browns and greens.
- ☐ I can tell what red worms need to live and what they make.
- ☐ I can tell why good soil matters to gardeners and farmers.

LESSONS IN THIS UNIT

3.1 Sand, Silt and Clay

2 sessions of 30–40 minutes

3.2 Humus: The Dark, Rich Part of Soil

2 sessions of 30–40 minutes

3.3 A Compost Pile: Browns and Greens

2 sessions of 30–40 minutes

3.4 A Worm Bin

2 sessions of 30–40 minutes

UNIT 3 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing, or showing with real soil. There are no points; listen for understanding.

1. Here are three samples. Use your fingers to tell me which is sand, which is like silt and which is clay.
2. What is humus, and how is it made?
3. Sort these into browns and greens: dry leaves, banana peel, newspaper, grass clippings, straw, coffee grounds.
4. Name two things that should never go in a home compost pile, and tell why.
5. What do red worms need to live in a bin?
6. Why is a gardener happy to find lots of worms in the soil?

ANSWER KEY

1. Sand is gritty, silt is smooth and silky like flour, clay is sticky when wet and makes a long ribbon.
2. Dark, crumbly soil made when dead leaves, plants and animals rot and are broken down by decomposers.
3. Browns: dry leaves, newspaper, straw. Greens: banana peel, grass clippings, coffee grounds.
4. Any two: meat, bones, fish, dairy, oily food, pet droppings. They smell, attract animals and can carry germs.
5. Damp bedding, air, darkness, the right temperature, and small amounts of fruit and vegetable scraps.
6. Worms make rich castings, mix humus into the soil, and make tunnels that let in air and water.

PORTFOLIO PIECE: MY LIVING SOIL REPORT

Make a soil report to show your family. Include your taped soil samples with ribbon-test results, your forest-floor layers drawing, a photo or drawing of your compost pile or jar, and your worm log. Finish by showing a handful of finished compost or worm castings (or dark humus from the woods) and telling how it was made.

LOOK FOR	WHAT IT MEANS
Soil textures	Tested at least two soils and can tell sand, silt and clay by feel.
Humus and decomposers	Can explain how leaves become humus and name two decomposers.
Compost	Started a compost pile or jar with browns and greens, and kept a log for at least three weeks.
Worm care	Fed and checked the worms (or the worm jar) faithfully and kept the bedding damp.

UNIT 4

PETS

A pet is a gift and a responsibility. In this unit your child learns what four popular pets need every single day: guinea pigs, hamsters and gerbils, cats, and parakeets. We look at food and water, a proper home, cleaning, gentle handling, health and cost, and we practice the faithful daily chores that good pet keepers do without being reminded.

No pet is needed. Every lesson can be done by planning a habitat and budget, visiting a pet store, shelter or friend's home, or pet-sitting for a neighbor. Our pictures include an Elizabethan family portrait with a guinea pig, a hamster from an old natural-history book, Henriëtte Ronner-Knip's kittens, and John Gould's parakeets drawn in Australia, where they live wild.

PREREQUISITES

- Knows that animals need food, water and shelter
- Can follow a short list of steps
- Can be gentle and quiet around animals

MASTERY CHECKLIST

- ☐ I can tell the daily needs of a guinea pig, including hay and vitamin C.
- ☐ I can tell how hamsters and gerbils are different and how to hold one safely.
- ☐ I can read a cat's body language and pet a cat gently.
- ☐ I can tell what a parakeet needs in its cage every day.
- ☐ I can make a daily and weekly chore chart for a pet.

LESSONS IN THIS UNIT

4.1 Guinea Pigs

2 sessions of 30–40 minutes

4.2 Hamsters and Gerbils

2 sessions of 30–40 minutes

4.3 Cats

2 sessions of 30–40 minutes

4.4 Parakeets

2 sessions of 30–40 minutes

UNIT 4 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing or acting out. There are no points; listen for understanding of daily care and gentle handling.

1. What should a guinea pig eat the most of, and what vitamin does it need every day?
2. Tell me two ways a hamster and a gerbil are different.
3. Show me how to pick up a small pet like a hamster safely.
4. A cat's ears are flat and its tail is twitching. What is it telling you, and what should you do?
5. Name three things you must do for a parakeet every day.
6. Why should you wash your hands after touching a pet or its cage?

ANSWER KEY

1. Hay, as much as it wants; vitamin C every day (from foods like bell pepper).
2. Any two: hamster has a stubby tail, gerbil a long furry tail; hamster has cheek pouches; Syrian hamsters live alone, gerbils in pairs; hamsters are nocturnal, gerbils awake off and on day and night; gerbils have long back legs.
3. Sit on the floor, let it sniff, scoop it up with two cupped hands, hold it low and never squeeze.
4. It is upset or annoyed; stop petting and leave it alone.
5. Any three: fresh water, refill food and blow away hulls, fresh vegetables, talk to it, cover the cage at night.
6. Animals and their cages can carry germs that make people sick.

PORTFOLIO PIECE: MY PET CARE PLAN

Choose one pet from this unit and make a complete care plan in a folder or on a poster: a drawing of its home, a daily menu, a daily and weekly chore chart, a first-month budget, and a page on gentle handling and safety. If your family has a pet, keep your chore chart for one week and check off each chore.

LOOK FOR	WHAT IT MEANS
Daily needs	Lists the right food, water and housing for the chosen pet.
Chores	Has a clear daily and weekly chore chart (and, with a real pet, kept it for a week without reminders).
Cost	Added up a first-month budget with a grown-up.
Kindness and safety	Can show gentle handling and explain hand-washing and other safety rules.

4.1 GUINEA PIGS

OBJECTIVES

- Tell what guinea pigs eat, including unlimited hay and daily vitamin C.
- Describe a good guinea pig home and why they should live in pairs.
- Plan daily and weekly guinea pig chores.

Warm-up. Look at a handful of hay, a carrot, a bell pepper slice, a leaf of romaine lettuce and a few pellets. Which one do you think a guinea pig should eat the most of? Make a guess, then find out in the lesson.

WATCH

10 Things You Need to Know BEFORE GETTING GUINEA PIGS - Part 1 | BEGINNERS GUIDE | Guinea Pig Care

Guinea Piggles · 5:03

<https://www.youtube.com/watch?v=dGP6JOj8Ya4>

WHEN TO WATCH

After the core ideas. Pause after each of the ten points and check it against your own list.

BACKUP VIDEO

Guinea Pig Care for New Owners: The ESSENTIAL 10 Minute Guide!

Squeak Dreams · 10:00

<https://www.youtube.com/watch?v=ZXKsyEYzAP4>

Before the hands-on project, for more about cage size, bedding and daily feeding.

KEY TERMS

guinea pig

A small, gentle rodent from South America, also called a cavy. It is not a pig and does not come from Guinea.

hay

Dried grass, such as timothy hay. It is the main food of guinea pigs and keeps their teeth worn down.

vitamin C

A vitamin found in peppers, oranges and leafy greens. Guinea pigs, like people, cannot make their own and must eat it every day.

herbivore

An animal that eats only plants.

cavy

Another name for a guinea pig. 4-H clubs and shows call them cavies.

CORE IDEAS

Guinea pigs are gentle, chatty little animals. When they are happy or hungry, they squeak and whistle, which keepers call “wheeking.” They are **herbivores**, which means they eat only plants.

Learn the parts of a cavy: the rounded **head** with petal-shaped **ears** and long **whiskers**, sharp front **teeth**, a sturdy **body** with no tail, short **legs**, four toes on each front foot and three on each back foot. There are many breeds. The **American** has short, smooth hair. The **Abyssinian** has rough hair that grows in swirls called rosettes. The **Peruvian** has very long, silky hair that needs daily brushing.

The most important guinea pig food is **hay**, and they should have all they want, all day long. Their front teeth never stop growing, and chewing hay wears them down. They also eat a small amount of guinea pig pellets and a cup of fresh vegetables each day, such as romaine lettuce, bell pepper and parsley.

Guinea pigs need **vitamin C** every day, because their bodies cannot make it, just like ours. Bell peppers are a favorite source. Without vitamin C, a guinea pig becomes sick. They also need clean, fresh water every day in a bottle or heavy bowl.

Guinea pigs are herd animals and get lonely by themselves, so they are best kept in pairs. Two guinea pigs need a large cage, at least about 7½ square feet of floor space, with soft bedding, a hiding house for each one, and room to run. Wire floors hurt their feet.

Daily chores: give fresh hay, water, vegetables and pellets, and pick out wet bedding and droppings. Weekly chores: change all the bedding and wash the bowls. Pick a

guinea pig up with two hands, one under the chest and one under the bottom, and hold it close and low. Never squeeze, and sit on the floor so it cannot fall far.

Guinea pigs often live five to seven years. Caring for one is a promise to feed and clean it faithfully for a long time.

PICTURE STUDY



Three Unknown Elizabethan Children, Unknown English artist, 1580s · Oil on panel · National Portrait Gallery, London

Image: [Wikimedia Commons](#), public domain

This portrait was painted in England more than four hundred years ago, not long after guinea pigs were first brought from South America to Europe. It is one of the oldest known pictures of a pet guinea pig in England. Guinea pigs were rare then, and owning one was something special.

Look closely

- Find the guinea pig. Who is holding it, and how?
- Look at the guinea pig's colors. Do guinea pigs today come in colors like these?
- Look at the children's fancy clothes and stiff ruffled collars. What does that tell you about the family?
- Look at the children's faces. Do they seem proud of their pet?

Talk about it

1. Is the child holding the guinea pig in a safe way? How would you hold one?
2. Why do you think the family wanted the guinea pig in their portrait?
3. Guinea pigs came from South America. How do you think they got to England in the 1500s?

Safety first. Hold small animals low to the ground with two hands, and never squeeze them. Wash your hands with soap after handling any pet or cleaning its cage.

HANDS-ON PROJECT

A Guinea Pig Home and Menu Plan

You will design a proper home for two guinea pigs and plan a week of meals, so you would be ready if your family ever adopted them. If you know someone with guinea pigs, ask to help with feeding and cleaning one day.

You will need

- Graph paper or plain paper
- A ruler and colored pencils
- A tape measure
- A grocery ad or a trip to the produce aisle (optional)
- A pet-store or shelter visit (optional)

Steps

1. Use a tape measure to mark out a rectangle on the floor about 30 inches by 36 inches. That is the smallest home for two guinea pigs. Sit inside it. Is it roomy?
2. On paper, draw your guinea pig home from above. Draw a hay rack, a water bottle, a food bowl, two hiding houses and a soft bedding area.
3. Make a weekly menu chart with seven days. For each day, list unlimited hay, a small scoop of pellets and one cup of fresh vegetables. Include a vitamin C vegetable like bell pepper every day.
4. Make a chore chart: daily (hay, water, food, spot-clean) and weekly (change bedding, wash bowls, check nails and teeth).
5. If you can, visit a pet store or animal shelter and look at the guinea pigs. Notice how they eat, hide and talk.
6. Ask a grown-up to help you find the price of a cage, a bag of hay and pellets. Add them up.

Tips

- Guinea pigs “popcorn” (hop straight up) when they are happy.
- Many shelters and rescues have guinea pigs waiting for homes.

Check your work

- ☐ My home plan has room for two guinea pigs, hiding houses, hay and water.
- ☐ My menu has hay every day and a vitamin C vegetable every day.
- ☐ I can show how to hold a guinea pig safely.

NATURE JOURNAL

1. Draw a cavy from a photo or real life. Label the head, ears, eyes, whiskers, front teeth, body, front feet (four toes) and back feet (three toes). Then draw an American, an Abyssinian and a Peruvian side by side.
2. Draw a plate of a guinea pig's daily food. Make the hay pile the biggest.
3. If you visit guinea pigs, write down three sounds or behaviors you noticed.
4. Start a pet record like a 4-H project book: for each day, the date, how much hay and vegetables were given, water refilled, chores done and any costs.

COMMON MISTAKES

- Feeding mostly pellets and treats. Hay should be most of the diet.
- Keeping a guinea pig alone in a tiny cage. They need a friend and room to run.

Make it a game • Guinea Pig Menu Duel. Draw a daily menu for a guinea pig on paper. Your grown-up quizzes you: how much hay, which vitamin, how many pigs live together? Defend each answer. Then your grown-up sneaks in one wrong food, like candy. If you spot it and say why, you win the round.

Scripture. "A righteous man regardeth the life of his beast:" (Proverbs 12:10, KJV)

A good person pays attention to what his animals need. Remembering hay, water and vitamin C every day is a way of being righteous and kind.

4.2 HAMSTERS AND GERBILS

OBJECTIVES

- Tell how hamsters and gerbils are alike and different.
- Describe what each needs: a roomy home, deep bedding, chew toys, food and water.
- Learn to handle a small rodent gently and safely.

Warm-up. Look at pictures of a hamster and a gerbil. Find three differences. (Look at the tails, the ears, the shape of the body and the legs.)

WATCH

How to Look After a Hamster 🐹 Basic Care Needs

AnimalWised · 4:35

<https://www.youtube.com/watch?v=08NT5qfmZec>

WHEN TO WATCH

After the core ideas. Pause on the cage set-up and name each thing a hamster needs.

Note: Some cages shown are smaller than experts now recommend; use the sizes in the core ideas.

BACKUP VIDEO

Basic Gerbil Care 🐭 | 5 Tips (for beginners)

Creature Glen · 6:36

<https://www.youtube.com/watch?v=0kBswpAwK2Q>

For the gerbil part of the lesson. Notice how deep the bedding is for digging.

KEY TERMS

rodent

An animal with front teeth that never stop growing, like mice, hamsters, gerbils and guinea pigs.

nocturnal

Awake at night. Hamsters sleep most of the day and wake up in the evening.

burrow

A tunnel and nest dug underground.
Hamsters and gerbils love to dig them.

cheek pouches

Stretchy pockets inside a hamster's cheeks where it carries food to store.

CORE IDEAS

Hamsters and gerbils are both small **rodents** with front teeth that never stop growing. Both need wooden chew toys to keep their teeth from growing too long, and both love to dig **burrows** in deep bedding.

A **hamster** has a round, chubby body, a tiny stub of a tail, and stretchy **cheek pouches**. It stuffs food into its pouches and carries it back to its nest to store. Hamsters are **nocturnal**: they sleep in the day and are busy at night. A Syrian (golden) hamster must live alone, because grown hamsters fight. Hamsters usually live about two to three years.

A **gerbil** is slimmer, with long back legs for hopping and a long, furry tail. Gerbils come from dry deserts, so they drink little and make small, dry droppings. Unlike hamsters, gerbils are awake off and on all day and night, and they are happiest in pairs. Gerbils live about three to four years.

Both need a big home with a solid floor, at least 6 to 10 inches of soft paper bedding to dig in, a hideout, a solid running wheel that is big enough that their backs do not bend, a water bottle, and rodent food with a few fresh vegetables. A glass tank with a secure mesh lid works well for gerbils, who are champion diggers.

To hold one, let it sniff your hand, then scoop it up gently with both hands cupped like a bowl. Sit on the floor so it cannot fall far. Never wake a sleeping hamster, never squeeze, and never pick a gerbil up by its tail; the skin can come off. A scared hamster may nip, so move slowly.

Daily chores: fresh water and food, and a quick look to see that your pet is eating and moving well. Weekly: spot-clean dirty corners. Every few weeks: change part of the bedding, leaving some old bedding so the home still smells familiar.

PICTURE STUDY



The Common Hamster, Unknown natural-history illustrator, 1800s · Hand-colored engraving ·
Freshwater and Marine Image Bank, University of Washington
Image: [Wikimedia Commons](#), public domain

Long before hamsters were pets, naturalists drew the wild hamster of European farm fields. Wild hamsters dig deep burrows with storerooms full of grain for winter. The pet golden hamster is a smaller cousin from Syria.

Look closely

- Find the hamster's cheeks. Can you imagine them stuffed with seeds?
- Look at the tail. Is it long or short?
- Look at its front paws. How might it use them?
- What colors are its fur on top and underneath?

Talk about it

1. Why would a wild hamster want to carry food back to a burrow?
2. How is a pet hamster's cage like a wild hamster's burrow?
3. How is this hamster different from a gerbil?

Safety first. Sit on the floor when holding a small pet, and use two cupped hands. Never pick up a gerbil by its tail. Wash your hands after handling pets, cages or bedding.

HANDS-ON PROJECT

Design a Hamster or Gerbil Habitat

You will design the perfect home for a hamster or a pair of gerbils and build a model of it, with a burrow, hideout, wheel and feeding area.

You will need

- A shoebox or small clear plastic box
- Shredded paper (for bedding)
- Toilet paper tubes and small cardboard boxes (for tunnels and hideouts)
- A bottle cap (for a food dish)
- Craft sticks, tape and glue
- Colored pencils and paper
- A ruler

Steps

1. Decide which pet you are designing for: one hamster or two gerbils. Write it on a label.
2. Fill the bottom of your box with a deep layer of shredded paper. Real bedding should be 6 to 10 inches deep.
3. Make a burrow: bury a toilet paper tube in the bedding so it makes a tunnel.
4. Make a hideout from a small box with a door cut in it.
5. Make a wheel from a circle of cardboard. Real wheels must be solid and big enough that the animal runs with a straight back.
6. Add a bottle-cap food dish, a pretend water bottle and a craft-stick chew toy.
7. Draw a chore chart beside your model: daily, weekly and every few weeks.

Tips

- Real habitats should be much bigger than a shoebox. Many experts suggest at least about 450 square inches of floor space for one hamster.
- Ask at a pet store or shelter to watch the hamsters and gerbils for a few minutes. Notice who is awake.

Check your work

- ☐ My habitat has deep bedding, a hideout, a wheel, food, water and a chew toy.
- ☐ I can tell two differences between hamsters and gerbils.
- ☐ I can show how to scoop up a small pet with two hands.

NATURE JOURNAL

1. Draw a hamster and a gerbil side by side. Label tail, ears, cheek pouches and back legs.
2. Write a “Day and Night” page: what a hamster does in the day and what it does at night.
3. Draw a cut-away of a burrow with a nest, a food storeroom and a tunnel.

COMMON MISTAKES

- Putting two grown Syrian hamsters together. They will fight; one hamster lives alone.
- Waking a sleeping hamster to play. It may bite. Play in the evening when it wakes up.

Make it a game • Hamster or Gerbil Habitat. Take turns building a habitat on paper, one item at a time: bedding, a wheel, chew toys, a water bottle. After each item, say which pet it is for and why it is needed. Mention that hamsters stuff their cheek pouches and both animals burrow. The best home gets a stamp.

4.3 CATS

OBJECTIVES

- Name a cat's daily needs: food, water, a clean litter box, play, rest and scratching.
- Read a cat's body language to know when it wants petting and when it wants to be left alone.
- Pet and play with a cat safely and kindly.

Warm-up. Act it out! The parent calls out a cat feeling (happy, scared, angry, sleepy), and the child shows it with pretend ears, tail and back. Then compare: what does a cat's tail do when it is happy?

WATCH

How to interact with your cat | The Battersea Way

Battersea Dogs and Cats Home • 3:33

<https://www.youtube.com/watch?v=UwqG2wLb0KQ>

WHEN TO WATCH

After the core ideas. Pause to copy the slow blink and the offered finger.

BACKUP VIDEO

Facts about Cats for Kids | Animal Learning Video

Homeschool Pop • 7:46

https://www.youtube.com/watch?v=33_1arqK0Dk

After the warm-up, to learn how cats' whiskers, eyes and claws work.

KEY TERMS

body language

How an animal shows its feelings with its ears, eyes, tail and body.

litter box

A box of sand-like litter where an indoor cat goes to the bathroom.

carnivore

An animal that eats mostly meat. Cats need meat-based cat food.

whiskers

Long, stiff hairs on a cat's face that help it feel its way and judge tight spaces.

CORE IDEAS

Cats have lived with families for thousands of years, catching mice in barns and keeping people company. A cat is a **carnivore**: it needs cat food made mostly from meat, not dog food or table scraps, and it always needs fresh, clean water.

Every day, a cat needs food, water, a clean **litter box**, a cozy place to sleep, a scratching post to keep its claws healthy, and play. Cats love to chase a feather wand or a ball. Play keeps them fit and happy. Once a year, a cat should visit the vet for a checkup and its shots.

Cats talk with their bodies. A tail held straight up, slow blinks, purring and rubbing against your legs mean “I am friendly.” Ears turned back or flat, a twitching or thumping tail, a puffed-up tail, hissing or growling mean “Leave me alone.” Always stop when a cat says stop.

To meet a cat, crouch down, hold out one finger, and let the cat come to you and sniff. Pet gently on the head, cheeks and chin, going the way the fur grows. Many cats do not like belly rubs. Never pull a tail or whiskers, never chase a cat that is hiding, and let it walk away when it wants to.

Scratches and bites can get infected, so wash any scratch with soap and water and tell a grown-up. Children should wash their hands after petting cats, and grown-ups should handle the litter box or supervise closely.

Indoor cats are safer from cars, coyotes and fights, and they help keep songbirds safe too. A cat often lives fifteen years or more, so a cat is a long promise of daily care.

PICTURE STUDY



Kittens at Play, Henriëtte Ronner-Knip, late 1800s · Oil on panel · Private collection

Image: [Wikimedia Commons](#), public domain

Henriëtte Ronner-Knip was a Dutch painter who spent much of her life painting cats. She built a glass-sided box in her studio so her cats and kittens could play safely while she watched and painted them. Look at how carefully she studied what cats do.

Look closely

- Find each kitten. What is each one doing?
- Look at the tails and ears. Do the kittens look playful, scared or sleepy?
- Find the grown cat. What is she doing while the kittens play?
- Look at the kittens' paws. Can you see the claws out or tucked in?

Talk about it

1. Why do you think kittens play-fight and pounce?
2. What toys could you give a cat so it can pounce and chase?
3. What does the mother cat's body tell you about how she feels?

Safety first. Let a cat come to you, pet it gently, and stop if its ears go back or its tail twitches. Wash any scratch or bite with soap and water and tell an adult. Wash your hands after touching a cat, and leave litter box cleaning to a grown-up or do it with gloves and help.

HANDS-ON PROJECT

A Cat Body-Language Chart and a Feather Toy

You will make a chart that helps your family read a cat's feelings, and make a simple wand toy so a cat can play safely. If you do not have a cat, visit a friend's cat or a shelter, or give the toy to a shelter.

You will need

- Poster paper and markers
- A wooden dowel or long stick
- Sturdy string or yarn, about 2 feet
- A few craft feathers or strips of fabric
- Tape

Steps

1. Fold your poster into two halves. Title one side "Happy and Friendly" and the other "Leave Me Alone."
2. On the happy side, draw a cat with its tail straight up, ears forward, soft eyes and a curled-up body.
3. On the leave-me-alone side, draw a cat with ears flat, a puffed or lashing tail, an arched back and wide eyes.
4. Under each picture, write or dictate what you should do.
5. Make the toy: tie or tape the string tightly to one end of the stick. Tie feathers or fabric strips to the other end of the string.
6. Play: drag the feathers slowly along the floor and around corners, like a mouse. Let the cat "catch" it sometimes.
7. Put the toy away after play so the cat cannot chew or swallow the string.

Tips

- Cats are most playful at dawn and dusk.
- Ask before petting anyone else's cat.

Check your work

- ☐ My chart shows at least three happy signs and three leave-me-alone signs.

- ☐ I can show how to meet a new cat.
- ☐ I know to put string toys away after play.

NATURE JOURNAL

1. Draw a cat from life or a photo. Label the whiskers, ears, eyes, paws, claws and tail.
2. Watch a cat for five minutes. Write down what its tail and ears did and what you think it was feeling.
3. Make a list of a cat's daily needs and weekly needs.

From history. Henriëtte Ronner-Knip began painting as a girl and became famous for her cats, often showing them getting into mischief with yarn, books and sewing baskets. She worked into her eighties and made hundreds of careful cat paintings.

COMMON MISTAKES

- Grabbing or hugging a cat tight. Let the cat choose to come close.
- Ignoring a twitching tail. That often means the cat is getting annoyed.

Make it a game • Cat Mood Charades. Take turns acting like a cat without words: tail up, slow blink, purring, flattened ears, puffed tail. The other player says whether the cat wants petting or wants to be left alone. Keep score. Finish by listing a cat's daily needs from memory, including a clean litter box and a place to scratch.

4.4 PARAKEETS

OBJECTIVES

- Tell what a parakeet needs: a roomy cage, a balanced diet, fresh water, toys and company.
- Know the daily and weekly chores for a pet bird.
- Learn how to approach a bird calmly and keep it safe.

Warm-up. Flap your arms like a bird for ten seconds. Now pretend you are in a box only a little bigger than you. Could you flap? Talk about why a bird needs a cage wide enough to fly from perch to perch.

WATCH

How to Care for a Budgie

Bird Nuggets • 2:49

<https://www.youtube.com/watch?v=H0UjkPr4u8w>

WHEN TO WATCH

After the core ideas. Name each item in the cage as it appears.

BACKUP VIDEO

How to Care for Your First Budgie (The Easy Way!)

Denny the Budgie • 4:12

<https://www.youtube.com/watch?v=O7JolmIZ2J8>

Before the hands-on project, for a second look at food, cage and toys.

KEY TERMS

parakeet (budgerigar)

A small, long-tailed parrot from Australia. In America, “parakeet” usually means a budgie.

flock

A group of birds that live together. Parakeets are flock birds and need company.

perch

A bar or branch where a bird stands and sleeps.

cuttlebone

A hard, white, chalky shell that pet birds nibble for calcium and to keep their beaks trim.

CORE IDEAS

Parakeets, also called budgies, come from the dry grasslands of Australia, where they fly in huge green and yellow **flocks**. Pet parakeets come in green, yellow, blue, white and more. They are cheerful, chattering birds, and some even learn to say a few words.

Because they are flock birds, parakeets get lonely. A single parakeet needs a lot of time with its family every day, and many keepers keep two so they have a friend.

A parakeet needs a cage wide enough to fly from **perch** to perch, with bars close together so it cannot squeeze its head through. Give it perches of different thicknesses, a few toys to chew and swing on, a **cuttlebone**, and a dish of clean water. Move toys around now and then so it does not get bored.

Feed a mix of good-quality seed and pellets, plus small amounts of fresh vegetables like leafy greens, carrots and broccoli. Never give chocolate or avocado, which are poisonous to birds. Birds also have very sensitive lungs, so keep the cage away from the kitchen, smoke and strong sprays.

Daily chores: change the water, refill food (blow away empty seed hulls, which can look like full seed), offer fresh veggies, and talk to your bird. Weekly: change the cage paper, wash dishes and perches. Cover the cage at night so the bird can sleep about ten to twelve hours.

Move slowly and talk softly near a bird. A tame parakeet may step onto your finger when you press it gently against its belly. Never grab a bird or squeeze it. Close windows and doors before a bird comes out of its cage. A healthy parakeet can live five to ten years or more.

PICTURE STUDY



Warbling Grass-Parrakeet, John Gould and Elizabeth Gould, 1840s · Hand-colored lithograph from *The Birds of Australia · The Birds of Australia*

Image: [Wikimedia Commons](#), public domain

John Gould and his wife Elizabeth traveled to Australia to study and draw its birds. Gould brought some of the first live budgerigars to England in 1840, and soon people everywhere wanted them as pets. This is what wild budgies look like.

Look closely

- Find the wavy black lines on the birds' backs and wings.
- Look at the colors. Wild budgies are green and yellow. What other colors are pet budgies today?
- Find the long tail feathers. What color are they?
- Look at the feet. How do they grip the grass?

Talk about it

1. Wild budgies live in big flocks. What does that tell you about how a pet budgie feels when it is alone?
2. What kind of food do you think wild budgies find in the grasslands?
3. How is a cage different from the wild? How can we make a cage a better home?

Safety first. Move slowly and quietly around birds and never squeeze them. Wash your hands after handling a bird or cleaning its cage. Keep birds away from kitchens, smoke and sprays, and close windows before a bird is let out.

HANDS-ON PROJECT

A Parakeet Care Kit Plan

You will plan everything a parakeet needs, add up the cost with a grown-up, and make a chore chart. If you know someone with a bird, ask to help change its water and food one day.

You will need

- Paper and colored pencils
- A pet supply catalog, store ad or website (with a grown-up)
- A calculator
- A visit to a pet store or a friend with a bird (optional)

Steps

1. Draw a parakeet cage with at least three perches of different sizes, a seed dish, a water dish, a cuttlebone, a veggie clip and two toys.
2. Make a shopping list for the cage and supplies. With a grown-up, find the price of each item and add it up.
3. Add the monthly costs: seed and pellets, fresh vegetables, cage paper, new toys.
4. Make a chore chart: daily (water, food, veggies, blow away hulls, talk), weekly (cage paper, wash dishes and perches), and nightly (cover the cage).
5. If you visit a store or a friend's bird, watch quietly for five minutes. What does the bird do? What sounds does it make?
6. Write or tell how you would keep the bird safe when it is out of its cage.

Tips

- Seed hulls left in the dish look like seed. Always blow or tip them away to check.
- Birds are happier with a cage near the family, not in a far-off room.

Check your work

- ☐ My cage drawing has perches, food, water, a cuttlebone and toys.
- ☐ My chore chart lists daily and weekly jobs.

- ☐ I can name two foods that are poisonous to birds.

NATURE JOURNAL

1. Draw a parakeet. Label the beak, the cere (the bump above the beak), wings, tail and feet.
2. Draw the wavy feather pattern of a budgie's back as carefully as you can.
3. Write the cost of a parakeet's first month. Was it more or less than you thought?

COMMON MISTAKES

- Thinking a full-looking seed dish is full. It may be only empty hulls.
- Putting the cage in the kitchen. Cooking fumes can harm a bird's lungs.

Make it a game • Parakeet Chore Calendar. Draw a week with seven boxes. Fill in daily chores and weekly chores for a parakeet from memory, like fresh water, food, cage wipe and a cuttlebone. Your grown-up checks it and asks why parakeets need company. Then bounce on a perch and chirp together to finish.

Scripture. "Are not five sparrows sold for two farthings, and not one of them is forgotten before God?" (Luke 12:6, KJV)

Even small, inexpensive birds matter to God. A little parakeet deserves our faithful care, because God does not forget even one sparrow.

UNIT 4

PETS

A pet is a gift and a responsibility. In this unit your child learns what four popular pets need every single day: guinea pigs, hamsters and gerbils, cats, and parakeets. We look at food and water, a proper home, cleaning, gentle handling, health and cost, and we practice the faithful daily chores that good pet keepers do without being reminded.

No pet is needed. Every lesson can be done by planning a habitat and budget, visiting a pet store, shelter or friend's home, or pet-sitting for a neighbor. Our pictures include an Elizabethan family portrait with a guinea pig, a hamster from an old natural-history book, Henriëtte Ronner-Knip's kittens, and John Gould's parakeets drawn in Australia, where they live wild.

PREREQUISITES

- Knows that animals need food, water and shelter
- Can follow a short list of steps
- Can be gentle and quiet around animals

MASTERY CHECKLIST

- ☐ I can tell the daily needs of a guinea pig, including hay and vitamin C.
- ☐ I can tell how hamsters and gerbils are different and how to hold one safely.
- ☐ I can read a cat's body language and pet a cat gently.
- ☐ I can tell what a parakeet needs in its cage every day.
- ☐ I can make a daily and weekly chore chart for a pet.

LESSONS IN THIS UNIT

4.1 Guinea Pigs

2 sessions of 30–40 minutes

4.2 Hamsters and Gerbils

2 sessions of 30–40 minutes

4.3 Cats

2 sessions of 30–40 minutes

4.4 Parakeets

2 sessions of 30–40 minutes

UNIT 4 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing or acting out. There are no points; listen for understanding of daily care and gentle handling.

1. What should a guinea pig eat the most of, and what vitamin does it need every day?
2. Tell me two ways a hamster and a gerbil are different.
3. Show me how to pick up a small pet like a hamster safely.
4. A cat's ears are flat and its tail is twitching. What is it telling you, and what should you do?
5. Name three things you must do for a parakeet every day.
6. Why should you wash your hands after touching a pet or its cage?

ANSWER KEY

1. Hay, as much as it wants; vitamin C every day (from foods like bell pepper).
2. Any two: hamster has a stubby tail, gerbil a long furry tail; hamster has cheek pouches; Syrian hamsters live alone, gerbils in pairs; hamsters are nocturnal, gerbils awake off and on day and night; gerbils have long back legs.
3. Sit on the floor, let it sniff, scoop it up with two cupped hands, hold it low and never squeeze.
4. It is upset or annoyed; stop petting and leave it alone.
5. Any three: fresh water, refill food and blow away hulls, fresh vegetables, talk to it, cover the cage at night.
6. Animals and their cages can carry germs that make people sick.

PORTFOLIO PIECE: MY PET CARE PLAN

Choose one pet from this unit and make a complete care plan in a folder or on a poster: a drawing of its home, a daily menu, a daily and weekly chore chart, a first-month budget, and a page on gentle handling and safety. If your family has a pet, keep your chore chart for one week and check off each chore.

LOOK FOR	WHAT IT MEANS
Daily needs	Lists the right food, water and housing for the chosen pet.
Chores	Has a clear daily and weekly chore chart (and, with a real pet, kept it for a week without reminders).
Cost	Added up a first-month budget with a grown-up.
Kindness and safety	Can show gentle handling and explain hand-washing and other safety rules.

UNIT 5

SEEDS AND WHAT PLANTS NEED

In late winter, gardeners start dreaming of spring. In this unit your child discovers how a plant makes its own food from sunlight, air and water, why warmth and frost matter so much, how water climbs from the roots to the leaves, and what the three big plant foods (nitrogen, phosphorus and potassium) do. Each lesson includes a simple experiment with beans, celery or seedlings that your child can watch change day by day.

Our pictures are a sunny poppy field by Claude Monet, a frosty morning by Camille Pissarro, Vincent van Gogh's *Irises*, and John Constable's *The Cornfield*. Start the bean seeds for Lesson 5.1 at the beginning of the unit so they are ready to use.

PREREQUISITES

- Knows the main parts of a plant: roots, stem, leaves, flower
- Has planted a seed before
- Can measure with a ruler in inches

MASTERY CHECKLIST

- ☐ I can tell that leaves make food for the plant from sunlight, air and water.
- ☐ I can explain what frost does to a warm-season plant and how to protect it.
- ☐ I can show with celery how water travels up a stem.
- ☐ I can name the three main plant foods and one job of each.
- ☐ I can run a fair test with two plants and record what happens.

LESSONS IN THIS UNIT

5.1 Plants Make Food from Light

2 sessions of 30–40 minutes

5.2 Warm and Cold: Temperature and Frost

2 sessions of 30–40 minutes

5.3 Water Travels Up the Stem

2 sessions of 30–40 minutes

5.4 Plant Food: Nitrogen, Phosphorus and Potassium

2 sessions of 30–40 minutes

UNIT 5 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing, or showing results from the experiments. There are no points; listen for understanding.

1. What three things does a leaf need to make food?
2. What happened to the bean plant you kept in the dark? Why?
3. What does frost do to a tomato plant, and how can a gardener protect it?
4. Show me on the celery how water travels up a plant.
5. What do the letters N, P and K stand for, and what is one job of each?
6. Why should a child never handle fertilizer alone?

ANSWER KEY

1. Sunlight, water and carbon dioxide from the air.
2. It grew pale, yellow and tall and thin, because without light it could not make food.
3. Frost freezes and breaks the leaf cells, so the plant turns black and dies. Cover it overnight with a sheet, bucket or frost blanket, or wait to plant until after the last frost.
4. Water goes up through tiny tubes (the strings/dots) from the bottom of the stem to the leaves.
5. Nitrogen: green leaves and growth. Phosphorus: roots, flowers and fruit.
Potassium: overall strength and sturdy stems.
6. Fertilizer can be harmful if touched or swallowed, and too much can burn plants. A grown-up reads the label and measures.

PORTFOLIO PIECE: MY PLANT NEEDS SCIENCE FAIR

Choose one experiment from this unit (light and dark beans, frost leaves, celery, or fed and unfed seedlings) and make a small science-fair display. Show the question you asked, what you did, your measurements or drawings, and what you learned. Present it to your family and answer their questions.

LOOK FOR	WHAT IT MEANS
Fair test	Changed only one thing and kept everything else the same.
Careful records	Measured, dated and drew the results at least four times.
Explaining	Can explain what happened and why, using words like light, frost, water tubes or nitrogen.
Presentation	Showed the display and answered questions clearly.

5.1 PLANTS MAKE FOOD FROM LIGHT

OBJECTIVES

- Tell that green leaves make sugar (food) from sunlight, air and water.
- Name chlorophyll as the green stuff in leaves that catches light.
- Test what happens to a plant kept in the dark.

Warm-up. Ask: “What did you eat today? Where did it get its food?” Trace one food back: bread comes from wheat, and wheat gets its food from... the sun! Try one more: milk comes from a cow, the cow eats grass, the grass gets its food from the sun.

WATCH

Photosynthesis for Kids - Introduction to Photosynthesis for Children: FreeSchool

Free School • 4:50

<https://www.youtube.com/watch?v=XCzFE0SB2N4>

WHEN TO WATCH

After the core ideas. Pause when the leaf takes in air and water and say the three things a plant needs to make food.

KEY TERMS

photosynthesis

The way green plants use sunlight to make food (sugar) from air and water. It means “putting together with light.”

chlorophyll

The green coloring in leaves that catches sunlight.

carbon dioxide

A gas in the air that people and animals breathe out and plants take in through tiny holes in their leaves.

oxygen

A gas in the air that we need to breathe. Plants give it off as they make food.

CORE IDEAS

Animals have to find food. Plants do something amazing: they make their own food, right inside their leaves. This is called **photosynthesis**, a long word that means

“putting together with light.”

A leaf needs three things to make food: **sunlight**, **water** that comes up from the roots, and **carbon dioxide**, a gas from the air that comes in through tiny holes on the underside of the leaf. Using the energy of sunlight, the leaf puts the water and the carbon dioxide together to make sugar. The sugar feeds the whole plant and helps it grow.

Leaves are green because of **chlorophyll**. Chlorophyll is like a little solar panel that catches sunlight. That is why leaves are wide and flat and turn toward the light: to catch as much sunshine as they can.

While making food, plants give off **oxygen**, the very gas we need to breathe. We breathe out carbon dioxide, and plants take it in. God made plants and people to help each other in a wonderful exchange.

A plant kept in the dark cannot make food. It grows pale and yellow and stretches tall and thin, looking for light. When it is put back in the sun, it turns green again. Gardeners give seedlings plenty of light so they grow short, sturdy and green.

PICTURE STUDY



Poppy Field, Claude Monet, 1873 · Oil on canvas · Musée d'Orsay, Paris

Image: [Wikimedia Commons](#), public domain

Claude Monet loved to paint outdoors in full sunlight. In this picture, a summer field near Paris glows with sunshine and red poppies. Every green blade of grass in it is busy making food from the sun.

Look closely

- Find the sky. Is it a sunny day or a cloudy one?
- Look at all the green in the field. What is all that green doing in the sunshine?
- Find the red poppies. Are there more in one part of the field?
- Find the people walking through the grass. Are they in the sun or the shade?

Talk about it

1. How does this grassland depend on the sun?
2. What would happen to the grass and the poppies if the sun did not shine for many days?
3. Monet painted outside instead of in his studio. Why do you think he wanted to see real sunlight?

HANDS-ON PROJECT

The Light and Dark Bean Test

You will grow bean seedlings, then keep one in the dark and one in the light for a week to see what light does for a plant.

You will need

- Four dry beans (bush beans or pole beans)
- Two small pots or cups with drainage holes
- Potting mix
- A sunny window
- A dark closet or a box to cover one pot
- A ruler
- A watering can

Steps

1. Soak the beans in water overnight. Plant two beans in each pot, about one inch deep. Water and set them in the sunny window.
2. Wait until both pots have seedlings about two inches tall with green leaves (about a week).
3. Label one pot “light” and one pot “dark.” This is a fair test: both pots are the same except for light.
4. Put the “dark” pot in a closet or under a box. Leave the “light” pot in the sunny window.
5. Give both pots the same amount of water when the soil is dry.
6. Every two days, measure the height of each plant and look at its color. Record it in your journal.
7. After one week, compare. Then put the dark plant back in the sun and watch it for a few more days. Does it turn green again?

Tips

- Turn the light pot a little each day so the stem grows straight.
- Leave the dark plant in the dark only one week, or it may die.

Check your work

- ☐ I kept everything the same except light.
- ☐ I measured and recorded both plants.
- ☐ I can explain why the dark plant turned pale.

NATURE JOURNAL

1. Draw a leaf. Draw arrows showing sunlight coming in from above, water coming up from the stem, carbon dioxide going in and oxygen going out.
2. Draw the light plant and the dark plant side by side after one week. Color them carefully and label the height of each.
3. Make a food chain that starts with the sun: sun, grass, cow, milk, me.

COMMON MISTAKES

- Thinking plants eat soil. Plants make their own food from light, air and water; soil gives them water and minerals.
- Changing two things at once in a test. Only the light should be different.

Make it a game • Light and Dark Predictions. Before looking at your bean test, predict out loud: which plant is greener and why? Use the words chlorophyll, sunlight, air and water in your answer. Your grown-up scores one point for each word used correctly. Then check the plants and see if your prediction was right. Try to beat your own score.

Scripture. “He causeth the grass to grow for the cattle, and herb for the service of man: that he may bring forth food out of the earth;” (Psalms 104:14, KJV)

God made plants able to turn sunlight into food. Every meal we eat began with a green leaf catching the light God made.

5.2 WARM AND COLD: TEMPERATURE AND FROST

OBJECTIVES

- Tell that seeds need warm enough soil to sprout, and that different seeds need different temperatures.
- Explain what frost does to tender plants and how gardeners protect them.
- Find your area's average last spring frost and first fall frost.

Warm-up. Use a thermometer to measure three places: inside the house, outside in the shade, and inside the refrigerator. Write the temperatures. Which place would a bean seed like best? Which would a lettuce seed tolerate?

WATCH

Where Does Frost Come From? | Winter Science | SciShow Kids

SciShow Kids · 4:23

<https://www.youtube.com/watch?v=MReufjGlz8s>

WHEN TO WATCH

After the warm-up. Pause when frost forms and say what temperature water freezes at.

BACKUP VIDEO

FROST PROTECTION in the Garden: WHAT TO COVER and WHY

Growing In The Garden · 5:55

<https://www.youtube.com/watch?v=FZ8h2bSYF0c>

Before the hands-on project. Listen for which plants need covering and which do not.

KEY TERMS

temperature

How hot or cold something is, measured with a thermometer in degrees.

frost

Ice crystals that form on plants and the ground when the temperature drops to freezing, 32 °F (0 °C).

last frost date

The average date in spring after which frost usually does not come again.
Warm-season crops are planted after it.

tender plant

A plant that is hurt or killed by frost, like a tomato, pepper or basil.

hardy plant

A plant that can live through frost and cold, like kale, spinach, garlic or pansies.

CORE IDEAS

Plants need the right **temperature** to grow. Seeds wait in the soil until it is warm enough, and then they sprout. Pea, spinach and lettuce seeds sprout in cool soil. Bean, squash, corn and tomato seeds need warm soil, about as warm as a spring afternoon, or they will rot before they sprout.

When the air drops to freezing, 32 °F, **frost** forms. Frost often comes on clear, calm, starry nights, when the warmth of the day escapes up into the sky. In the morning you may see white, sparkly ice crystals on the grass and cars.

Frost freezes the water inside a plant's leaves. Ice takes up more room than water, so it breaks the tiny cells of the leaf. When the sun comes out, **tender plants** such as tomatoes, peppers, beans, basil and squash turn black and mushy. **Hardy plants** such as kale, spinach, cabbage and garlic have ways to handle the cold and keep growing.

Gardeners watch the weather. In spring, they wait to plant tender crops until after the **last frost date** for their area. In fall, they watch for the first frost. If frost is coming, they cover plants overnight with an old sheet, a bucket or a frost blanket. The cover holds in the earth's warmth like a blanket on a bed. They take it off in the morning.

Too much heat can hurt plants too. In very hot weather, lettuce turns bitter and goes to seed, and tomato flowers may drop off. Every plant has a temperature it likes best.

God set the cold and heat, summer and winter, in their order. Wise gardeners learn the rhythm of their own place and plant at the right time.

PICTURE STUDY



Hoarfrost, Camille Pissarro, 1873 · Oil on canvas · Musée d'Orsay, Paris

Image: [Wikimedia Commons](#), public domain

Camille Pissarro painted this on a frosty morning in the French countryside. The plowed field is covered with white frost, and the sun is low. When it was first shown, some people laughed at it, but today it is treasured for how truly it shows a cold, bright morning.

Look closely

- Find the white frost on the furrows of the field. Which parts are still white?
- Find the long shadows. Where do you think the trees are?
- Find the person on the road. What is he carrying, and why might he need it on a cold day?
- Look at the sky. Is it cloudy or clear? (Frost often comes after clear nights.)

Talk about it

1. Why does the frost stay longest in the shadows?
2. What would happen to a tomato plant in this field this morning?
3. Which crops could still be growing in a garden on a frosty morning like this?

Safety first. A grown-up helps with the freezer part of the experiment. Do not touch frozen metal with wet hands.

HANDS-ON PROJECT

The Frost Experiment and My Frost Dates

You will see for yourself what freezing does to a tender leaf and a hardy leaf, and find the frost dates for where you live.

You will need

- A leaf of basil or a slice of cucumber (tender)
- A leaf of kale or cabbage (hardy)
- Two zip bags and a marker
- The freezer
- A thermometer
- A calendar
- Internet or a phone call to your county extension office (with a grown-up)

Steps

1. Put a basil leaf in one bag and a kale leaf in the other. Label them.
2. Put both bags in the freezer overnight.
3. In the morning, take them out and let them thaw on a plate for 30 minutes.
4. Compare: which leaf turned dark and mushy? Which stayed firm and green? Draw both.
5. With a grown-up, look up your average last spring frost date and first fall frost date. Your county extension office or a seed company's frost-date tool can tell you.
6. Mark both dates on a calendar. Count the days between them. That is your growing season.
7. On the next clear, cold evening, put a thermometer outside on the ground and one under an overturned bucket. Check both in the morning. Was it warmer under the bucket?

Tips

- Real kale has natural sugars that help it handle cold, which is one reason it tastes sweeter after frost.

- Low spots and the bottoms of hills get frost first, because cold air sinks.

Check your work

- ☐ I can tell what frost does to a tender plant.
- ☐ I know my last spring frost date and first fall frost date.
- ☐ I can name two ways to protect plants from frost.

NATURE JOURNAL

1. Draw the basil leaf and the kale leaf after freezing and thawing. Label them tender and hardy.
2. Write your frost dates in big numbers on a page, and draw a garden calendar with a warm season in between.
3. On a frosty morning, draw the frost crystals you see on a leaf or window with a magnifying glass.

COMMON MISTAKES

- Planting tomatoes and peppers on the first warm day of spring. Wait until after your last frost date.
- Leaving frost covers on all day. Take them off in the morning so plants get light and do not overheat.

Make it a game • Frost Night Rescue. Spread paper plants on the floor. Some are tender and some hardy. Your grown-up shouts, Frost tonight! You rush to cover the tender ones with a towel and leave the hardy ones. Say what frost does and what a last frost date means. Do three rounds and keep your best score.

5.3 WATER TRAVELS UP THE STEM

OBJECTIVES

- Tell that roots take in water and tiny tubes in the stem carry it up to the leaves.
- Watch colored water travel up a celery stalk.
- Tell that water leaves the plant through tiny holes in the leaves.

Warm-up. Put a paper towel strip with one end in a cup of colored water. Watch for three minutes. What happens? Water can climb up through tiny spaces. Plants have tiny tubes too.

WATCH

The Color-Changing Celery Experiment!

SciShow Kids · 4:13

<https://www.youtube.com/watch?v=Klug9Foou3s>

WHEN TO WATCH

Before the hands-on project. Set up your celery right after watching, the same way.

BACKUP VIDEO

ACTIVITIES CORNER: Celery & Food Coloring Experiment | Britannica Kids

Encyclopaedia Britannica · 2:05

<https://www.youtube.com/watch?v=4FKHPHh78uc>

A short second look at the same experiment, for review.

KEY TERMS

roots

The parts of a plant that grow underground, hold the plant in place, and soak up water and minerals.

stem

The part of a plant that holds it up and carries water up and food down.

tubes (xylem)

Tiny pipes inside the stem that carry water from the roots to the leaves.

wilt

To droop and go limp because the plant does not have enough water.

CORE IDEAS

A plant cannot walk to a stream for a drink. Instead, its **roots** spread through the soil and soak up water through thousands of tiny root hairs.

From the roots, the water travels up through tiny **tubes** inside the **stem**, like a bundle of very thin drinking straws. These tubes run all the way up into every leaf. In a celery stalk, you can see the strings; those strings are the bundles of tubes.

The water does not stop in the leaves. Much of it slips out as invisible water vapor through tiny holes on the underside of the leaves. As water leaves the top, more water is pulled up from below, like sipping through a straw. A big tree can pull up hundreds of gallons of water on a hot summer day.

Water does many jobs. It carries minerals from the soil, it is used to make food in the leaves, and it fills the plant's cells so the plant stands up firm. When a plant does not get enough water, its cells go soft and it **wilts**. Water it, and in a few hours it stands up again.

This is why gardeners water at the roots, not just on the leaves, and why they water deeply so the roots grow down. The Bible says a good person is like a tree planted by the rivers of water: its roots drink deeply, so its leaves stay green.

PICTURE STUDY



Irises, Vincent van Gogh, 1889 · Oil on canvas · J. Paul Getty Museum, Los Angeles

Image: [Wikimedia Commons](#), public domain

Van Gogh painted these irises in the garden of a hospital in southern France, where he was resting and getting well. He called painting them “the lightning conductor” for his sickness. Look how every leaf and flower stands tall and firm. Each one is full of water pulled up from the roots.

Look closely

- Find the long, pointed leaves. Do they stand straight up or droop?
- Find the one white iris. Why do you think Van Gogh added it?
- Look at the soil at the bottom left. What color is it?
- Find a flower that is drooping or bending. What might it need?

Talk about it

1. How do you think the water gets from the soil all the way up to the iris flowers?
2. What would these irises look like after a long dry week with no rain?
3. If you could paint one flower very large, which would you choose?

Safety first. Food coloring stains clothes and tables. Wear an old shirt and cover the table. A grown-up does the cutting.

HANDS-ON PROJECT

The Color-Changing Celery Test

You will watch colored water climb up celery stalks, then cut them open to see the tubes.

You will need

- 3 or 4 fresh celery stalks with leaves
- 3 or 4 clear glasses or jars
- Water
- Red and blue food coloring
- A knife (grown-up only)
- A magnifying glass
- A ruler
- A white carnation or white flower (optional)

Steps

1. Fill each glass half full of water. Add about 15 drops of food coloring to each: red in one, blue in one, and leave one plain for comparison.
2. Have a grown-up cut a fresh slice off the bottom of each celery stalk.
3. Put one stalk in each glass. Write the time.
4. Check after 1 hour, 4 hours and the next morning. Look at the leaves. Do you see color?
5. The next day, have a grown-up cut one stalk across. Look at the cut end with the magnifying glass. Count the colored dots. Each dot is a bundle of tubes.
6. Have a grown-up split one stalk the long way. Follow the colored lines up toward the leaves and measure how far the color went.
7. Bonus: split the bottom of a white carnation stem in two, and put one half in red water and the other in blue. See what happens to the petals.

Tips

- Stalks with leaves work faster, because the leaves pull the water up.

- Put one glass in a warm, sunny spot and one in a cool spot. Which pulls water faster?

Check your work

- ☐ I can show where the water tubes are in a celery stalk.
- ☐ I can explain how water gets from the roots to the leaves.
- ☐ I recorded the time and what I saw.

NATURE JOURNAL

1. Draw the cut end of a celery stalk and color in the dots where the tubes are.
2. Draw a whole plant with blue arrows showing water going up from the roots, through the stem, to the leaves, and out into the air.
3. Record your celery test: the time, the color you saw, and how far it traveled.

COMMON MISTAKES

- Forgetting to cut a fresh end on the celery. A dried-out end will not drink well.
- Watering only the leaves of a garden plant. Water the soil, where the roots are.

Make it a game • Up the Stem Relay. Line up family members or stuffed animals as tubes from the floor to a pretend leaf on a chair. Pass a cup of pretend water up the line while you say: roots take it in, tubes carry it up. Race to get it to the leaf. Say what happens if the plant wilts.

Scripture. “And he shall be like a tree planted by the rivers of water, that bringeth forth his fruit in his season; his leaf also shall not wither; and whatsoever he doeth shall prosper.” (Psalms 1:3, KJV)

A tree near a river always has water for its roots, so its leaves stay green. A person who loves God’s word is like that tree: always drinking from what keeps him strong.

5.4 PLANT FOOD: NITROGEN, PHOSPHORUS AND POTASSIUM

OBJECTIVES

- Name the three main plant nutrients: nitrogen (N), phosphorus (P) and potassium (K).
- Tell one main job of each: green leaves, roots and flowers, and overall strength.
- Read the three numbers on a fertilizer label with an adult, and do a fair test with compost.

Warm-up. Look at a bag of potting mix, a bag of compost and a fertilizer box (a grown-up holds it). Find the three numbers on the fertilizer, like 5-5-5 or 10-10-10. What could they mean? Make a guess.

WATCH

NPK Explained

Proven Winners Professionals - Retailers · 1:25

<https://www.youtube.com/watch?v=trYLhTCP9jM>

WHEN TO WATCH

After the core ideas. A short, clear look at the three numbers. Watch it twice.

BACKUP VIDEO

NPK Fertilizer Numbers - what they really mean

Garden Fundamentals · 7:48

<https://www.youtube.com/watch?v=BGVU75oRKyo>

For parents who want to know more. Children can watch the first three minutes.

KEY TERMS

nutrient

Something a living thing needs to grow and stay healthy. Plants get most of their nutrients from the soil.

nitrogen (N)

A nutrient that helps plants grow green, leafy and tall.

phosphorus (P)

A nutrient that helps plants grow strong roots, flowers and fruit.

potassium (K)

A nutrient that keeps the whole plant strong and healthy, with sturdy stems.

fertilizer

Plant food that gardeners add to the soil to give plants more nutrients.

CORE IDEAS

Plants make their own sugar from sunlight, air and water, but they also need small amounts of minerals from the soil to build healthy leaves, roots and fruit. These are called **nutrients**. Three are needed the most.

Nitrogen (letter N) helps plants grow green leaves and tall stems. A plant without enough nitrogen grows slowly, and its older, lower leaves turn pale yellow.

Phosphorus (letter P) helps plants grow strong roots, flowers, fruit and seeds.

Potassium (letter K) helps the whole plant stay strong and healthy, with sturdy stems and good fruit. An easy way to remember: N is for “up” (leaves), P is for “down” (roots) and flowers, and K is for “all around.”

A bag of **fertilizer** shows three numbers, like 10-10-10. They always come in the same order: N, P, K. The numbers tell how much of each nutrient is inside. A fertilizer for lawns might have a big first number for green grass. A fertilizer for tomatoes might have more P and K for flowers and fruit.

Gardeners can feed plants with compost, aged manure, worm castings, or store-bought fertilizers. Compost and castings feed slowly and gently and also add humus. Too much fertilizer can burn roots and harm the plant, so more is not better. Grown-ups read the label, wear gloves, and measure carefully. Children never handle fertilizer by themselves.

A farmer named George Washington Carver taught that soil must be fed and cared for. Good gardeners give back to the soil what their crops take out.

PICTURE STUDY



The Cornfield, John Constable, 1826 · Oil on canvas · National Gallery, London

Image: [Wikimedia Commons](#), public domain

John Constable painted the English countryside where he grew up. Here a boy stops to drink from a stream while his dog drives the sheep down a shady lane. Through the gap in the trees you can see a field of ripe grain, which the English call “corn.” Fields like this grow well only when the soil is fed.

Look closely

- Find the field of golden grain. How tall and thick does it look?
- Find the boy drinking from the stream. What else in the picture needs water?
- Find the dog and the sheep. How might sheep help feed a field?
- Look at the big trees. Are they healthy and green?

Talk about it

1. What would this grain field look like if the soil had little nitrogen?
2. Farmers long ago let sheep graze fields after harvest. How would that feed the soil?
3. Why do you think Constable loved to paint the fields of his childhood?

Safety first. Children do not handle fertilizer. A grown-up reads the label, wears gloves and measures. Wash your hands after touching compost, soil or plants.

HANDS-ON PROJECT

The Fed and Unfed Seedling Test

You will grow two sets of seedlings in poor soil. One set will get compost, and one will not, so you can see what plant food does.

You will need

- Four small pots or cups with drainage holes
- Plain sand or very poor soil (not potting mix with fertilizer in it)
- Finished compost or worm castings (from Unit 3, or bagged)
- Radish, lettuce or bean seeds
- Labels
- A ruler
- A watering can
- Gloves

Steps

1. Fill two pots with plain sand or poor soil. Label them “no food.”
2. Fill two pots with the same sand mixed half and half with compost or castings. Label them “fed.”
3. Plant the same number of seeds at the same depth in each pot.
4. Put all four pots side by side in the same sunny place, and give them the same amount of water.
5. Every three days for three weeks, measure the tallest seedling in each pot and look at the leaf color.
6. Record your results in a chart. At the end, gently tip out one plant from each set and compare the roots.
7. With a grown-up, look at a fertilizer box. Find the three numbers and say which nutrient each one is.

Tips

- Keep everything the same except the food. That is a fair test.

- Pale yellow lower leaves on the unfed plants may be a sign of too little nitrogen.

Check your work

- ☐ I can name N, P and K and one job of each.
- ☐ I kept my test fair.
- ☐ I can read the three numbers on a fertilizer label in the right order.

NATURE JOURNAL

1. Draw a plant and label it: N for leaves (up), P for roots and flowers (down), K for the whole plant (all around).
2. Make a growth chart for your fed and unfed seedlings over three weeks.
3. Draw a leaf that is healthy green and one that is pale yellow. Write which might need more nitrogen.

From history. George Washington Carver was born into slavery in Missouri and became a great farm scientist. He taught farmers in the South that growing cotton year after year wore out their soil, and that planting peanuts, sweet potatoes and cowpeas could help rebuild it. He was a man of deep Christian faith who said he asked God to show him the secrets of the peanut.

COMMON MISTAKES

- Thinking more fertilizer is always better. Too much can burn roots.
- Testing with potting mix that already has fertilizer in it. Use plain sand or poor soil for a fair test.

Make it a game • N-P-K Job Match. Write N, P and K on three cards. Your grown-up calls a job: green leaves, roots and flowers, or overall strength. Slap the right card fast. Then say what fertilizer is and why the fed seedling grew taller. Play until you answer ten in a row without a mistake.

UNIT 5

SEEDS AND WHAT PLANTS NEED

In late winter, gardeners start dreaming of spring. In this unit your child discovers how a plant makes its own food from sunlight, air and water, why warmth and frost matter so much, how water climbs from the roots to the leaves, and what the three big plant foods (nitrogen, phosphorus and potassium) do. Each lesson includes a simple experiment with beans, celery or seedlings that your child can watch change day by day.

Our pictures are a sunny poppy field by Claude Monet, a frosty morning by Camille Pissarro, Vincent van Gogh's *Irises*, and John Constable's *The Cornfield*. Start the bean seeds for Lesson 5.1 at the beginning of the unit so they are ready to use.

PREREQUISITES

- Knows the main parts of a plant: roots, stem, leaves, flower
- Has planted a seed before
- Can measure with a ruler in inches

MASTERY CHECKLIST

- ☐ I can tell that leaves make food for the plant from sunlight, air and water.
- ☐ I can explain what frost does to a warm-season plant and how to protect it.
- ☐ I can show with celery how water travels up a stem.
- ☐ I can name the three main plant foods and one job of each.
- ☐ I can run a fair test with two plants and record what happens.

LESSONS IN THIS UNIT

5.1 Plants Make Food from Light

2 sessions of 30–40 minutes

5.2 Warm and Cold: Temperature and Frost

2 sessions of 30–40 minutes

5.3 Water Travels Up the Stem

2 sessions of 30–40 minutes

5.4 Plant Food: Nitrogen, Phosphorus and Potassium

2 sessions of 30–40 minutes

UNIT 5 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing, or showing results from the experiments. There are no points; listen for understanding.

1. What three things does a leaf need to make food?
2. What happened to the bean plant you kept in the dark? Why?
3. What does frost do to a tomato plant, and how can a gardener protect it?
4. Show me on the celery how water travels up a plant.
5. What do the letters N, P and K stand for, and what is one job of each?
6. Why should a child never handle fertilizer alone?

ANSWER KEY

1. Sunlight, water and carbon dioxide from the air.
2. It grew pale, yellow and tall and thin, because without light it could not make food.
3. Frost freezes and breaks the leaf cells, so the plant turns black and dies. Cover it overnight with a sheet, bucket or frost blanket, or wait to plant until after the last frost.
4. Water goes up through tiny tubes (the strings/dots) from the bottom of the stem to the leaves.
5. Nitrogen: green leaves and growth. Phosphorus: roots, flowers and fruit.
Potassium: overall strength and sturdy stems.
6. Fertilizer can be harmful if touched or swallowed, and too much can burn plants. A grown-up reads the label and measures.

PORTFOLIO PIECE: MY PLANT NEEDS SCIENCE FAIR

Choose one experiment from this unit (light and dark beans, frost leaves, celery, or fed and unfed seedlings) and make a small science-fair display. Show the question you asked, what you did, your measurements or drawings, and what you learned. Present it to your family and answer their questions.

LOOK FOR	WHAT IT MEANS
Fair test	Changed only one thing and kept everything else the same.
Careful records	Measured, dated and drew the results at least four times.
Explaining	Can explain what happened and why, using words like light, frost, water tubes or nitrogen.
Presentation	Showed the display and answered questions clearly.

UNIT 6

FARM ANIMALS AND BEES

Early spring is a busy time on a farm. In this unit your child meets goats, dairy and beef cattle, horses and ponies, and the honeybees that turn flower nectar into honey. We learn what each animal eats, how it is housed and cared for, what it gives us, and the daily chores that farm families do faithfully in every kind of weather.

We speak simply and honestly: farm animals give us milk, wool, work, eggs, honey and meat. No family needs to own livestock for this unit. The best way to learn is to visit a farm, a 4-H fair, a petting farm or a beekeeper, and watch closely. The pictures we study are by Rosa Bonheur, Julien Dupré and Pieter Bruegel the Elder.

PREREQUISITES

- Can name common farm animals
- Knows that milk, eggs and honey come from animals
- Can follow safety rules around animals with an adult

MASTERY CHECKLIST

- ☐ I can tell what goats eat and what they give us.
- ☐ I can tell the difference between dairy cattle and beef cattle and why cows chew their cud.
- ☐ I can name three tools used to groom a horse and the most important horse safety rule.
- ☐ I can explain, step by step, how bees turn nectar into honey.
- ☐ I can make a daily chore schedule for a farm animal.

LESSONS IN THIS UNIT

6.1 Goats

2 sessions of 30–40 minutes

6.2 Dairy and Beef Cows on Grass

2 sessions of 30–40 minutes

6.3 Horses and Ponies

2 sessions of 30–40 minutes

6.4 From Flower to Honey

2 sessions of 30–40 minutes

UNIT 6 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing or acting out. There are no points; listen for understanding and for the safety rules.

1. What do goats like to eat, and what do they give people?
2. What is the difference between a dairy cow and a beef cow?
3. Why does a cow lie down and keep chewing when she is not eating?
4. Name the grooming tools for a horse in order, and tell me the most important safety rule around horses.
5. Put these in order: bees fan the honey, a bee sips nectar, bees cap the cell, bees put nectar in the comb, the bee flies home.
6. What should you do if a bee buzzes near you?

ANSWER KEY

1. Hay, leaves, twigs and weeds (they browse), with minerals and water. They give milk, cheese, fiber and meat, and they clear brush.
2. Dairy cattle (like Holsteins and Jerseys) are raised for milk; beef cattle (like Angus and Herefords) are raised for meat.
3. She is chewing her cud: food brought back up from her stomach to chew again.
4. Curry comb, stiff brush, soft brush, mane comb, hoof pick. Never stand behind a horse; approach from the side.
5. Sip nectar, fly home, put nectar in comb, fan it dry, cap the cell.
6. Stay calm, do not swat, and slowly walk away. Tell a grown-up if you are stung.

PORTFOLIO PIECE: A FARM VISIT JOURNAL

Visit a farm, 4-H fair, petting farm, stable or beekeeper with your family (or study one closely through books and videos). Make a farm journal with drawings and notes about at least two animals from this unit: what they eat, how they are housed, what they give us, and the daily chores. Include your butter recipe or honey tasting notes and a thank-you note to the farmer.

LOOK FOR	WHAT IT MEANS
Observation	Drew and described at least two farm animals or bees from real life or close study.
Care and chores	Listed the food, housing and daily chores for each animal.
What animals give us	Named what each animal gives people.
Gratitude	Wrote or dictated a thank-you note to the farmer or beekeeper.

6.1 GOATS

OBJECTIVES

- Tell what goats eat and how they like to browse.
- Name what goats give people: milk, cheese, fiber and meat.
- Describe a goat's daily care: food, water, shelter, strong fences, hoof trimming and company.

Warm-up. Look at a picture of a goat's eye. The pupil is a sideways rectangle. Hold your hands beside your eyes like blinders, then take them away. A goat's wide pupils let it see almost all the way around without turning its head, which helps it watch for danger while it eats.

WATCH

Help Farmer Jason Take Care of The Goats! (Fun Educational Video For Toddlers and Preschoolers)

Cog Hill Farm For Kids with Farmer Jason · 13:32

<https://www.youtube.com/watch?v=nAC2l4U-hqc>

WHEN TO WATCH

After the core ideas. Write down each chore Farmer Jason does for his goats.

Note: Made for young children, but it shows real daily goat chores on a working family farm.

BACKUP VIDEO

Goats For Kids | Facts About Goats | Learn About Goats | Animals For Kids

Kids' Corner · 4:44

<https://www.youtube.com/watch?v=ZxUYrNJVL5g>

A short fact review after the picture study.

KEY TERMS

browse

To nibble leaves, twigs and bushes.
Goats are browsers, while sheep and cows mostly graze on grass.

doe, buck and kid

A female goat is a doe (or nanny), a male is a buck (or billy), and a baby is a kid.

herd

A group of animals that live together.
Goats need at least one goat friend.

hoof

The hard foot of a goat, cow or horse.
Goat hooves must be trimmed every few weeks.

ruminant

An animal with a stomach of four parts
that chews its food twice, like goats,
sheep and cows.

CORE IDEAS

Goats are curious, clever and full of energy. They climb on rocks, stumps and anything else they can find. God made them sure-footed, with hooves that grip like rubber, so wild goats can live on steep mountainsides.

Goats are **browsers**. They love to nibble leaves, twigs, weeds and bushes more than plain grass. On a farm they eat good hay, browse, a little grain, and loose minerals made for goats. They need fresh, clean water every day. Goats are picky about clean food and will not eat hay that has fallen on the ground. Despite the stories, they do not eat tin cans!

Like cows, goats are **ruminants**. Their stomach has four parts. They swallow their food quickly, then later bring it back up and chew it again. This is called chewing the cud. A goat lying quietly chewing is a happy goat.

Goats give people many good things. Dairy goats give milk, which can be made into cheese, butter, yogurt and soap. Some goats, like Angoras, grow soft hair for weaving. Some goats are raised for meat. Goats are also used to clear brush and weeds from land.

A goat keeper's chores: feed hay and fresh water morning and evening, milk dairy goats twice a day, clean the shelter, trim hooves every six to eight weeks, and check that the fences are strong. Goats are escape artists; farmers say that a fence that will not hold water will not hold a goat. Goats are herd animals and get lonely, so always keep at least two.

A good keeper knows each animal by name and notices when one is not eating or is acting differently. The Bible says to know the state of your flocks and look well to

your herds.

PICTURE STUDY



Young Girl with Goat and Flowers, Émile Munier, 1890 · Oil on canvas · Private collection

Image: [Wikimedia Commons](#), public domain

Émile Munier was a French painter who loved to paint children in the countryside. Here a hungry goat has found the leaves and flowers a girl has gathered in her apron. It shows exactly what goats love to do: browse!

Look closely

- Find what the goat is reaching for. Is it eating grass from the ground, or leaves and flowers up high?
- Look at the goat's horns, ears and legs. How do they look built for climbing and stretching?
- Look at the girl's face and hand. Is she cross with the goat or gentle?
- Look at the rocky ground. Is it a place a goat would like?

Talk about it

1. Why does the goat reach up instead of eating the grass at its feet?
2. How should you hold out food to a goat to keep your fingers safe?
3. What good things could a family get from a goat like this one?

Safety first. Visit goats only with an adult and follow the farmer's rules. Keep fingers flat when offering food, never tease a goat, and stay away from bucks. Wash your hands with soap after touching any farm animal. Biosecurity tip: wash your hands before and after touching farm or fair animals, and never share buckets, brushes or feed scoops between farms, so germs do not travel from one herd to another.

HANDS-ON PROJECT

A Goat Keeper's Chore Chart and Farm Visit

You will visit goats at a farm, petting zoo or fair if you can, and make a chore chart for a pair of dairy goats.

You will need

- A notebook and pencil for a farm visit
- Poster paper and markers
- A clock face drawing or stamp
- A camera (optional)

Steps

1. If you can, visit goats with a grown-up. Ask the farmer what the goats eat, how often they are milked, and how often their hooves are trimmed.
2. Watch a goat eat for two minutes. Does it browse leaves or eat grass? Does it chew its cud?
3. Make a chore chart with three columns: morning, evening and weekly.
4. Morning: hay, fresh water, milking, check each goat. Evening: hay, fresh water, milking, close the shelter. Weekly: clean bedding, check fences, check hooves.
5. Draw a little clock beside morning and evening chores to show the time.
6. At the bottom, list what the goats give the family: milk, cheese, and more.
7. Hang the chart on the wall and tell someone how you would care for goats.

Tips

- 4-H county fairs in summer often have goat barns where young people show their goats. They love to answer questions.
- If you cannot visit a farm, watch the video closely and copy each chore.

Check your work

- ☐ My chart has morning, evening and weekly chores.
- ☐ I can name three things goats give people.

- ☐ I can tell why goats need a friend and strong fences.

NATURE JOURNAL

1. Draw a goat and label the horns, beard, hooves, udder (on a doe) and tail.
2. Draw a goat's eye with its sideways pupil.
3. Write or tell what goats eat and what they give us.

From history. Long before tractors, a family goat often supplied the milk for a whole household, and goats are still called “the poor man’s cow.” Today many young people raise and show dairy goats through 4-H clubs and county fairs; check your county extension office or fair book to learn how.

COMMON MISTAKES

- Thinking goats eat anything. They need good hay, browse and clean water.
- Keeping one goat alone. Goats are herd animals.

Make it a game • Goat Browse Hunt. Hide ten paper leaves around the room. Be a goat and browse by finding them with your mouth closed and your hands as hooves. Collect leaves into a basket. Then name four things goats give people, and say what a doe, a buck and a kid are. Beat your own time on the second hunt.

Scripture. “Be thou diligent to know the state of thy flocks, and look well to thy herds.” (Proverbs 27:23, KJV)

A wise farmer watches his animals every day. Knowing each goat and noticing when one is sick is part of faithful care.

6.2 DAIRY AND BEEF COWS ON GRASS

OBJECTIVES

- Tell the difference between dairy cattle and beef cattle.
- Explain that cows turn grass into milk and meat, and why they chew their cud.
- Describe how farmers move cattle to fresh pasture.

Warm-up. Look at the food in your refrigerator. Find every food that came from a cow: milk, butter, cheese, yogurt, ice cream, hamburger. Line them up. Cows make all of this from grass!

WATCH

Everything You Need To Know About Cows! Educational Farm Video

Oliver and Lucas - Educational Videos for Kids · 10:50

<https://www.youtube.com/watch?v=kLCzmkz05D4>

WHEN TO WATCH

After the warm-up. Pause after each part and add a fact to your cow chart.

Note: Filmed on a small family farm where children help hand-milk the cows and feed the calves.

BACKUP VIDEO

Dairy from Cows with George the Farmer

George the Farmer · 7:22

https://www.youtube.com/watch?v=zaWW2wA_jQY

Before the core idea about dairy cows, to see a real milking shed.

KEY TERMS

cattle

Cows, bulls, steers and calves. A cow is a grown female, a bull is a grown male, and a calf is a baby.

dairy cattle

Cattle raised to give milk, such as black-and-white Holsteins and brown Jerseys.

beef cattle

Cattle raised for meat, such as black Angus and red-and-white Herefords.

pasture

A field of grass where animals graze.

cud

Food a cow brings back up from its stomach to chew again.

CORE IDEAS

People cannot eat grass, but cows can, and they turn it into milk and meat. That makes cattle one of the most useful animals God gave to people. A cow eats a large amount of grass or hay and drinks a whole bathtub of water or more every day.

Like goats, cows are **ruminants** with a four-part stomach. A cow tears off grass with her tongue and swallows it. Later, resting in the shade, she brings it back up as **cud** and chews it slowly for a long time. Tiny helpers living in her stomach break down the tough grass.

Dairy cattle are raised for milk. A mother cow makes milk after she has a calf in the spring. On a dairy farm, cows are milked at least twice a day, every day, early in the morning and in the evening, often by machines in a milking parlor. Holsteins are black and white and give the most milk. Jerseys are smaller and brown, and their milk is rich and creamy.

Beef cattle are raised for meat. Black Angus and red-and-white Herefords are common breeds. Beef calves stay with their mothers on pasture through the summer. When they are grown, they are sold, and their meat becomes hamburger and roast beef. Leather for shoes and belts comes from cattle too.

Many farmers move their cattle to a fresh section of **pasture** every few days. The cows eat the grass, leave their manure behind to feed the soil, and move on, and the grass grows back thick and green before they return. This careful grazing keeps both the cattle and the land healthy.

Daily chores on a cattle farm include fresh water, checking that every animal is healthy, moving fences or feeding hay in winter, and for dairy farms, milking twice a day, 365 days a year, even on Christmas.

PICTURE STUDY



The White Cow, Julien Dupré, about 1890 · Oil on canvas · Private collection

Image: [Wikimedia Commons](#), public domain

Julien Dupré was a French painter who loved to paint farm families at work in the fields. In this picture, a woman milks a cow right out in the pasture on a bright summer day. Before milking machines, every drop of milk was squeezed out by hand like this.

Look closely

- Find the milk pail. Where is it placed?
- Look at how the woman is sitting. Why would she sit on a low stool?
- Look at the pasture. Is the grass thick and green?
- Find the cottage and the woman in the doorway. What might she be doing to help?

Talk about it

1. Is this a dairy cow or a beef cow? How do you know?
2. How many times a day would this woman need to milk her cow?
3. How is milking today different from milking in this picture?

Safety first. Cows are big and strong. Visit only with an adult, stay on the farmer's side of the fence unless invited, never walk behind a cow, and wash your hands with soap after touching cattle or fences. Biosecurity tip: wash your hands before and after touching farm or fair animals, and never share buckets, brushes or feed scoops between farms, so germs do not travel from one herd to another.

HANDS-ON PROJECT

From Grass to Glass: A Farm Visit and Butter in a Jar

You will follow milk from the pasture to your table and make butter from cream, just like farm families have done for centuries.

You will need

- A small jar with a tight lid (a baby-food or jam jar)
- Heavy whipping cream, at room temperature
- A pinch of salt
- A cracker or slice of bread
- Paper and colored pencils

Steps

1. If you can, visit a dairy farm, a 4-H fair cattle barn or a farm that sells milk. Watch cows eat and ask how often they are milked.
2. Fill the jar about halfway with cream. Close the lid tightly.
3. Shake, shake, shake! Take turns with your family. After a few minutes, the cream will get thick like whipped cream.
4. Keep shaking. Suddenly you will hear a thump: a lump of yellow butter has formed in thin, watery buttermilk.
5. Pour off the buttermilk (you can drink it). Rinse the butter in cold water and add a pinch of salt.
6. Spread your butter on a cracker and give thanks for the cow that made it.
7. Draw a “grass to glass” chain: sun, grass, cow, milk, cream, butter.

Tips

- Room-temperature cream turns to butter faster.
- Put a clean marble in the jar to make shaking faster (a grown-up removes it afterward).

Check your work

- ☐ I can tell the difference between dairy and beef cattle.
- ☐ I made butter and can tell how cream turns into butter.

- ☐ I can explain why cows chew their cud.

NATURE JOURNAL

1. Draw a Holstein and an Angus side by side. Label which is dairy and which is beef.
2. Draw a cow lying down chewing her cud. Draw arrows to show grass going down and cud coming back up.
3. Draw a pasture divided into sections, with cows in one section and grass growing back in the others.

COMMON MISTAKES

- Thinking all cows are boys or that all cattle give milk. Only mother cows that have had calves give milk.
- Thinking brown cows give chocolate milk. All plain milk is white.

Make it a game • Dairy or Beef Quiz. Your grown-up reads statements: gives milk every day, raised for meat, eats grass in a pasture, chews cud. Shout dairy, beef or both. Then explain in three steps how grass turns into milk. Get a point for each step. Hold up a jar and shake it like butter if you can.

6.3 HORSES AND PONIES

OBJECTIVES

- Tell what horses eat and how they are housed.
- Name the main grooming tools and why hooves need care.
- Know the main safety rules around horses.

Warm-up. Measure your height in “hands,” the way horses are measured: one hand is 4 inches. Have someone measure you from the floor to your shoulder and divide by 4. A pony is shorter than 14½ hands at the shoulder; a horse is taller.

WATCH

Horse Care For Beginners

JSHorsemanship · 7:48

<https://www.youtube.com/watch?v=fdGhd2phEHs>

WHEN TO WATCH

After the core ideas. Name each tool or chore as the horse keeper shows it.

BACKUP VIDEO

How to Groom a Horse (Step-By-Step Guide)

Carmella Abel - Equine Helper · 12:10

<https://www.youtube.com/watch?v=Plb64MqF0Ks>

Before the hands-on project. Watch the order of the brushes: curry comb, hard brush, soft brush, hoof pick.

KEY TERMS

pony

A small kind of horse, less than 14½ hands (58 inches) tall at the shoulder.

farrier

A skilled worker who trims horses' hooves and puts on horseshoes.

hand

The unit used to measure a horse's height. One hand equals 4 inches.

curry comb

A rubber brush with little teeth that loosens dirt and hair, used in circles.

hoof pick

A small hooked tool used to clean mud and stones out of the bottom of a hoof.

CORE IDEAS

For thousands of years, horses have helped people plow fields, pull wagons, carry riders and herd cattle. God made horses strong, fast and willing to work. Today horses still work on some farms and ranches, and many families ride them for pleasure.

Horses are grazing animals with a simple stomach, not ruminants. They eat grass and hay little by little almost all day long. A horse eats a lot of hay each day and drinks many gallons of water. Some horses also get a little grain. A horse needs a pasture or paddock to move around in, shelter from wind and rain, and other horses for company.

Grooming keeps a horse clean and healthy and lets the keeper check for cuts and sore spots. First the **curry comb** is rubbed in circles to loosen dirt. Then a stiff brush flicks the dirt away, and a soft brush smooths the coat. A comb untangles the mane and tail.

“No hoof, no horse,” say horsemen. Hooves keep growing like fingernails. Every day the keeper lifts each foot and cleans it with a **hoof pick**. Every six to eight weeks, a **farrier** trims the hooves and may put on horseshoes.

Horses are gentle but very big, and they startle easily. Always walk up to a horse from the side, near its shoulder, and speak so it knows you are there. **Never stand or walk right behind a horse**, because a startled horse can kick. Keep your hand flat when offering a treat. Always have a grown-up with you, and wear a helmet to ride.

A **pony** is a small horse, less than 14½ hands tall. Ponies are often sturdy and clever, and many children learn to ride on them.

PICTURE STUDY



The Horse Fair, Rosa Bonheur, 1852–1855 • Oil on canvas • Metropolitan Museum of Art, New York

Image: [Wikimedia Commons](#), public domain

Rosa Bonheur visited a horse market in Paris twice a week for a year and a half to sketch the horses being bought and sold. Then she painted this huge picture, more than 16 feet wide. It made her famous all over the world. These are big farm horses, called draft horses, bred to pull heavy loads.

Look closely

- Find the horse that is rearing up. How does the handler hold it?
- Look at the horses' legs and necks. Do they look strong? What work might they do?
- Find the different colors of horses.
- Find a handler being careful to stay out of the way of the horses' hooves.

Talk about it

1. Why would a farmer want a big, strong horse like these long ago?
2. What safety rules do you think the handlers are following?
3. Rosa Bonheur watched horses for a long time before she painted. Why does that make a picture better?

Safety first. Be with an adult whenever you are near horses. Approach from the side at the shoulder, speak softly, never stand behind a horse, keep your hand flat for treats, and wear a helmet when riding. Wash your hands after grooming or touching horses. Biosecurity tip: wash your hands before and after touching farm or fair animals, and never share buckets, brushes or feed scoops between farms, so germs do not travel from one herd to another.

HANDS-ON PROJECT

A Grooming Kit and Horse Care Book

You will make a little book about horse care and practice the grooming order. If you can, visit a stable, therapeutic riding center or 4-H horse show and watch a horse being groomed.

You will need

- Paper folded and stapled into a small book
- Colored pencils
- Pictures of a curry comb, brushes and hoof pick (drawn or printed)
- A stuffed animal or toy horse (for practice)
- Real brushes if you visit a stable

Steps

1. On the cover, draw a horse or pony and write a title: “How I Would Care for a Horse.”
2. Page 1: What a horse eats and drinks each day (hay, grass, water, a little grain).
3. Page 2: A horse’s home (pasture, shelter, a friend).
4. Page 3: Grooming tools in order: curry comb, stiff brush, soft brush, mane comb, hoof pick. Draw each one.
5. Page 4: The farrier and hoof care.
6. Page 5: Horse safety rules, with a big X over a person standing behind a horse.
7. Practice the grooming order on a stuffed animal: curry in circles, brush with the hair, comb the mane, pretend to pick each hoof.
8. If you visit a stable, ask to watch (or help, with permission) as someone grooms a horse.

Tips

- Many towns have riding stables or therapeutic riding centers that welcome visitors.

- Horses like to be scratched on the withers, the bump at the base of the neck, where horses groom each other.

Check your work

- ☐ My book has five pages about horse care.
- ☐ I can name the grooming tools in order.
- ☐ I can tell the most important horse safety rule.

NATURE JOURNAL

1. Draw a horse and label the mane, tail, withers, hooves and muzzle.
2. Draw the bottom of a hoof and the hoof pick that cleans it.
3. Measure your height in hands and write it down. Draw yourself next to a 14-hand pony.

From history. Rosa Bonheur needed special permission from the Paris police to wear trousers so she could work safely among the horses and cattle at markets and farms. *The Horse Fair* was bought by an American collector and given to the Metropolitan Museum of Art in New York, where it still hangs.

COMMON MISTAKES

- Walking behind a horse. Always go around the front or stay close to its side with a hand on it, with a grown-up.
- Holding treats in your fingers. Keep your hand flat.

Make it a game • Horse Groom Memory Tray. Put a curry comb, brush, hoof pick and a cloth on a tray. Look for ten seconds, then cover it. Name each tool and what it does. Your grown-up removes one while your eyes are closed and you guess the missing tool. Say why a farrier takes care of hooves.

Scripture. “hast thou clothed his neck with thunder?” (Job 39:19, KJV)

God asked Job whether he had given the horse its strength. The horse’s power and beauty come from God, and a good horseman cares for that gift gently.

6.4 FROM FLOWER TO HONEY

OBJECTIVES

- Name the three kinds of bees in a hive: queen, workers and drones.
- Explain step by step how bees turn nectar into honey.
- Tell how bees help flowers make fruit and seeds, and how to be safe around bees.

Warm-up. Taste a tiny bit of honey on a spoon (unless your child is allergic). Then dip a cotton swab in sugar water and “visit” paper flowers around the room, like a bee. Talk about how many flowers a bee must visit.

WATCH

How do bees make honey?

Mystery Science · 5:50

<https://www.youtube.com/watch?v=cDIHHCgbMc4>

WHEN TO WATCH

After the warm-up. Pause after each step and put your honey-step cards in order.

BACKUP VIDEO

How Do Bees Make Honey? | The Science of Food! | SciShow Kids

SciShow Kids · 6:02

<https://www.youtube.com/watch?v=A4YlpGQiD3w>

For review on the second day. Pause when the bees fan their wings and explain why the water must leave.

KEY TERMS

nectar

A sweet, watery liquid inside flowers that bees drink and turn into honey.

worker bee

A female bee that does all the work of the hive: cleaning, feeding, building comb, guarding and gathering food.

pollen

A yellow dust made by flowers. Bees carry it from flower to flower and eat it for protein.

queen bee

The one mother bee in the hive who lays all the eggs.

drone

A male bee. Drones do not gather food or sting.

honeycomb

Six-sided wax cells that bees build to store honey and raise young bees.

CORE IDEAS

A honeybee hive is like a busy little town. It has one **queen**, who lays all the eggs; thousands of **workers**, who are all females and do every job; and some **drones**, the males. Young workers clean, feed baby bees and build comb. Older workers guard the door and fly out to gather food.

A forager bee flies from flower to flower and sips sweet **nectar** with her long tongue. She stores it in a special pouch called her honey stomach. One bee may visit hundreds of flowers on a single trip.

Back at the hive, she passes the nectar mouth to mouth to house bees. They add something from their bodies that begins to change the nectar, and they put it into wax **honeycomb** cells. Nectar is very watery, so the bees fan their wings over the cells to dry it until it becomes thick and sticky. Then they seal each cell with a wax cap. Now it is honey, food to last the bees through winter.

Bees also gather **pollen** in little baskets on their back legs. As they go from flower to flower, pollen rubs off and helps the flowers make seeds and fruit. Apples, blueberries, cucumbers, squash and many other foods need bees to visit their flowers.

A strong hive makes more honey than the bees need. A beekeeper takes only the extra, leaving plenty for the bees. Honey has been treasured for thousands of years; the Promised Land was called “a land flowing with milk and honey.”

Honeybees sting only to protect themselves or their hive. Walk calmly near bees, never swat at them, and never touch a hive. Beekeepers wear veils and suits and work slowly and gently. Tell a grown-up right away if you are stung, and know if anyone in your family is allergic. Babies under one year old should never be given honey.

PICTURE STUDY



The Beekeepers, Pieter Bruegel the Elder, about 1568 · Pen and ink · Kupferstichkabinett, Berlin

Image: [Wikimedia Commons](#), public domain

Long ago, bees were kept in hives woven from straw, called skeps. In this drawing, Pieter Bruegel shows beekeepers dressed in thick clothes with woven masks over their faces, carrying their skeps. Their clothing protected them, just as beekeepers' veils and suits do today.

Look closely

- Find the straw hives, called skeps. How many can you count?
- Look at the beekeepers' faces. What are they wearing? Why?
- Find the boy in the tree. What do you think he is doing?
- Look at how the beekeepers move. Are they hurrying or moving carefully?

Talk about it

1. Why do you think the beekeepers cover their faces?
2. How is a straw skep different from the wooden box hives beekeepers use today?
3. What do you think the beekeepers will do with the honey?

Safety first. Never touch a hive or swat at bees. Visit bees only with an adult beekeeper, who will give you a veil. Tell an adult right away if you are stung, and know whether anyone in your family has a bee allergy. Do not give honey to babies under one year old.

HANDS-ON PROJECT

A Honey Tasting and a Bee-Flower Pot

You will taste and compare different honeys and plant flowers that feed bees. If you can, visit a beekeeper or a farmers' market honey stand and ask questions.

You will need

- Two or three kinds of honey (clover, wildflower, orange blossom or local honey)
- Spoons or crackers
- A 10-inch pot with a drainage hole, or a sunny garden spot
- Potting mix
- Seeds of zinnias, sunflowers or borage, or a small plant of lavender, thyme or oregano
- A watering can
- Picture cards for the honey steps (drawn by you)

Steps

1. Draw five picture cards: bee sips nectar; bee carries nectar home; bees pass it and put it in comb; bees fan their wings; bees cap the cell with wax. Mix them up and put them in order.
2. Set out the honeys. Look at the color of each. Is one light and one dark?
3. Taste a little of each on a spoon or cracker. Describe each one: mild, strong, flowery?
4. Read the labels. The kind of flower the bees visited changes the color and taste.
5. Fill your pot with potting mix and plant bee flowers, following the seed packet.
6. Water gently and put the pot in full sun. Keep it watered.
7. When it blooms, watch for bees from a calm distance and count how many visit in five minutes.

Tips

- Local farmers' markets often sell honey from nearby beekeepers who love to talk about their bees.
- Bees especially like blue, purple and yellow flowers.

Check your work

- ☐ I can put the five honey steps in order.
- ☐ I can name the queen, workers and drones and one job of each.
- ☐ I can tell three safety rules for bees.

NATURE JOURNAL

1. Draw a honeybee and label the head, wings, legs, pollen baskets and stinger.
2. Draw a piece of honeycomb with six-sided cells. Color some cells as capped honey, some as pollen and some as baby bees.
3. Write the five steps from flower to honey in your own words.

From history. In 1851, a Pennsylvania minister named Lorenzo Langstroth discovered that bees leave a gap of about three-eighths of an inch between their combs. He designed a wooden hive with movable frames spaced just right, so beekeepers could lift out combs without breaking them. Most beekeepers still use his kind of hive today.

COMMON MISTAKES

- Thinking bees carry honey from flowers. They carry nectar and make it into honey in the hive.
- Swatting at a bee. Stay calm and still or walk away slowly.

Make it a game • Honey Step Chain. Stand in a circle with your grown-up. Tell the path from flower to honey one step at a time, each person adding the next step: bee visits, drinks nectar, carries it home, shares it, fans it, stores it in honeycomb. Say who the queen, workers and drones are before finishing.

Scripture. “More to be desired are they than gold, yea, than much fine gold: sweeter also than honey and the honeycomb.” (Psalms 19:10, KJV)

The psalm says God's words are sweeter than honey from the comb. Just as bees work hard to store up honey, we can store up God's words in our hearts.

UNIT 6

FARM ANIMALS AND BEES

Early spring is a busy time on a farm. In this unit your child meets goats, dairy and beef cattle, horses and ponies, and the honeybees that turn flower nectar into honey. We learn what each animal eats, how it is housed and cared for, what it gives us, and the daily chores that farm families do faithfully in every kind of weather.

We speak simply and honestly: farm animals give us milk, wool, work, eggs, honey and meat. No family needs to own livestock for this unit. The best way to learn is to visit a farm, a 4-H fair, a petting farm or a beekeeper, and watch closely. The pictures we study are by Rosa Bonheur, Julien Dupré and Pieter Bruegel the Elder.

PREREQUISITES

- Can name common farm animals
- Knows that milk, eggs and honey come from animals
- Can follow safety rules around animals with an adult

MASTERY CHECKLIST

- ☐ I can tell what goats eat and what they give us.
- ☐ I can tell the difference between dairy cattle and beef cattle and why cows chew their cud.
- ☐ I can name three tools used to groom a horse and the most important horse safety rule.
- ☐ I can explain, step by step, how bees turn nectar into honey.
- ☐ I can make a daily chore schedule for a farm animal.

LESSONS IN THIS UNIT

6.1 Goats

2 sessions of 30–40 minutes

6.2 Dairy and Beef Cows on Grass

2 sessions of 30–40 minutes

6.3 Horses and Ponies

2 sessions of 30–40 minutes

6.4 From Flower to Honey

2 sessions of 30–40 minutes

UNIT 6 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing or acting out. There are no points; listen for understanding and for the safety rules.

1. What do goats like to eat, and what do they give people?
2. What is the difference between a dairy cow and a beef cow?
3. Why does a cow lie down and keep chewing when she is not eating?
4. Name the grooming tools for a horse in order, and tell me the most important safety rule around horses.
5. Put these in order: bees fan the honey, a bee sips nectar, bees cap the cell, bees put nectar in the comb, the bee flies home.
6. What should you do if a bee buzzes near you?

ANSWER KEY

1. Hay, leaves, twigs and weeds (they browse), with minerals and water. They give milk, cheese, fiber and meat, and they clear brush.
2. Dairy cattle (like Holsteins and Jerseys) are raised for milk; beef cattle (like Angus and Herefords) are raised for meat.
3. She is chewing her cud: food brought back up from her stomach to chew again.
4. Curry comb, stiff brush, soft brush, mane comb, hoof pick. Never stand behind a horse; approach from the side.
5. Sip nectar, fly home, put nectar in comb, fan it dry, cap the cell.
6. Stay calm, do not swat, and slowly walk away. Tell a grown-up if you are stung.

PORTFOLIO PIECE: A FARM VISIT JOURNAL

Visit a farm, 4-H fair, petting farm, stable or beekeeper with your family (or study one closely through books and videos). Make a farm journal with drawings and notes about at least two animals from this unit: what they eat, how they are housed, what they give us, and the daily chores. Include your butter recipe or honey tasting notes and a thank-you note to the farmer.

LOOK FOR	WHAT IT MEANS
Observation	Drew and described at least two farm animals or bees from real life or close study.
Care and chores	Listed the food, housing and daily chores for each animal.
What animals give us	Named what each animal gives people.
Gratitude	Wrote or dictated a thank-you note to the farmer or beekeeper.

UNIT 7

PLANTING

Spring is planting time. In this unit your child learns where and how to plant: repotting a houseplant that has outgrown its pot, starting a windowsill herb garden, building and filling a raised bed, and planting a fruit tree or berry bush that may bear fruit for many years. Every lesson ends with something real growing.

Families without a yard can do every lesson with pots: a houseplant, a windowsill of herbs, a large container or grow bag in place of a raised bed, and a pot of strawberries or a dwarf blueberry on a balcony. Our pictures show gardens painted by Claude Monet, Carl Larsson, Gustave Caillebotte and Camille Pissarro.

PREREQUISITES

- Knows what plants need: light, water, warmth, air and nutrients
- Has planted seeds in a pot
- Knows the last frost date for your area (from Unit 5)

MASTERY CHECKLIST

- ☐ I can tell when a plant needs a bigger pot and repot it gently.
- ☐ I can grow at least three herbs on a sunny windowsill and harvest them the right way.
- ☐ I can tell why raised beds are useful and what goes inside them.
- ☐ I can plant a tree or bush at the right depth and water it well.
- ☐ I can make a planting plan that puts each plant where it will grow best.

LESSONS IN THIS UNIT

7.1 Repotting a Houseplant

2 sessions of 30–40 minutes

7.2 A Windowsill Herb Garden

2 sessions of 30–40 minutes

7.3 Raised Beds

2 sessions of 30–40 minutes

7.4 Planting a Fruit Tree or Berry Bush

2 sessions of 30–40 minutes

UNIT 7 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing, or showing a plant. There are no points; listen for understanding.

1. Name two signs that a houseplant needs a bigger pot.
2. Why must every pot have a drainage hole?
3. Show me how to harvest herbs so they keep growing.
4. Tell me two reasons gardeners like raised beds.
5. When you plant a tree, how deep should it go?
6. Why does a gardener need patience with a fruit tree?

ANSWER KEY

1. Any two: roots coming out of the drainage hole, roots circling in a tight web, water running straight through, soil drying very fast, the plant tipping over.
2. So extra water can run out; roots sitting in water rot.
3. Pinch or snip from the top just above a pair of leaves, and take no more than a third of the plant.
4. Any two: soil warms faster, drains well, can be filled with good soil, stays loose because no one steps on it, easier to reach.
5. Only as deep as the root ball, with the root flare at or slightly above the soil line.
6. It may take several years to bear fruit, and it needs faithful watering and care until then.

PORTFOLIO PIECE: MY SPRING PLANTING MAP

Make a map of everything you planted this unit: the repotted houseplant, the windowsill herbs, the raised bed or container, and the fruit tree, bush or strawberries. Draw each one where it grows (in the house, by the window, in the yard), label it with the planting date, and add a photo or drawing of each. Keep watering everything for at least three weeks and add notes about how each plant is doing.

LOOK FOR	WHAT IT MEANS
Planting	Planted or repotted at least three things from this unit with grown-up help.
Right place	Can explain why each plant was put where it is (sun, drainage, room to grow).
Faithful care	Watered and checked the plants without reminders for three weeks.
Map and records	The map is labeled with plants, dates and notes.

7.1 REPOTTING A HOUSEPLANT

OBJECTIVES

- Tell the signs that a plant needs a bigger pot.
- Choose a pot only a little bigger, with a drainage hole.
- Repot a houseplant gently, keeping the roots healthy.

Warm-up. Look at the bottom of two or three houseplant pots. Do you see any roots poking out of the drainage holes? Lift each pot. Which feels lightest right after watering? Talk about what those clues might mean.

WATCH

How to Repot a Houseplant // Garden Answer

Garden Answer • 2:47

<https://www.youtube.com/watch?v=-gqR81-hMPY>

WHEN TO WATCH

Before the hands-on project. Watch how the gardener loosens the roots and how deep she sets the plant.

BACKUP VIDEO

How to repot a plant? | Beginners Guide to Repotting

This is a Plant • 7:39

<https://www.youtube.com/watch?v=Fy8kP2EYpcY>

After the core ideas, for more about root-bound plants and choosing the right pot size.

KEY TERMS

repot

To move a plant into a new, usually bigger pot with fresh soil.

drainage hole

A hole in the bottom of a pot that lets extra water run out so roots do not drown.

root-bound

When roots fill the whole pot and grow around and around in circles because they have no more room.

potting mix

A light, fluffy soil made for pots, usually of peat or coir, bark, perlite and compost.

CORE IDEAS

A plant in a pot can grow only as big as its roots have room. After a year or two, many houseplants fill their pots with roots. Then it is time to **repot**.

Signs a plant needs a new pot: roots grow out of the **drainage hole**, water runs straight through without soaking in, the soil dries out very fast, or the plant looks too big and tips over. When you slide it out, the roots are packed in a tight web or circling around and around. That plant is **root-bound**.

Choose a new pot just one or two inches wider than the old one. A pot that is too big holds too much wet soil, and the roots can rot. Every pot must have a drainage hole. Use fresh **potting mix**, not garden soil, which packs down hard in a pot.

To repot: water the plant the day before. Tip the pot on its side and gently slide the plant out, holding it at the base, never yanking the stem. Tease apart circling roots with your fingers. Put some fresh mix in the new pot, set the plant at the same depth it was before, fill in around the sides, and press gently. Water slowly until water comes out the bottom.

A repotted plant may droop for a few days while its roots settle in. Keep it out of hot, direct sun for a week and do not overwater. Soon new roots will grow into the fresh soil, and the plant will put out new leaves.

Caring for a houseplant is a small, quiet stewardship. Watering when the soil is dry, giving it light, and repotting when it is crowded teaches the same patience every gardener needs.

PICTURE STUDY



The Artist's Garden at Vétheuil, Claude Monet, 1881 · Oil on canvas · National Gallery of Art, Washington

Image: [Wikimedia Commons](#), public domain

Claude Monet and his family rented a house in the village of Vétheuil, with a garden running down toward the river. Monet's little son Michel stands on the path between towering sunflowers. Look at the blue and white pots lined up on the steps.

Look closely

- Find the blue and white pots on the steps. How many can you count?
- Look at the sunflowers. How tall are they compared to the little boy?
- Find the people. Who might they be?
- Look at the light. Which parts of the garden are in bright sun?

Talk about it

1. Why might a gardener grow some plants in pots instead of in the ground?
2. What would the plants in these pots need from the gardener every day in summer?
3. Which plants in this garden do you think will need bigger pots soon?

Safety first. Wash your hands after handling potting mix, and do not breathe in its dust; dampen it first. Some houseplants are poisonous to eat or irritate skin, so ask a grown-up which plant to repot and wear gloves if needed.

HANDS-ON PROJECT

Give a Plant a New Home

You will check a houseplant for signs it needs a bigger pot, and repot it step by step.

You will need

- A houseplant that has outgrown its pot (a pothos, spider plant, snake plant or herb from the store works well)
- A new pot 1 to 2 inches wider, with a drainage hole
- Fresh potting mix
- Newspaper or an old tablecloth
- A trowel or big spoon
- A watering can
- A ruler

Steps

1. Water the plant the day before so the roots slide out easily.
2. Spread newspaper on the table. Measure and write down the height of the plant and the width of the old pot.
3. Turn the old pot on its side. Hold the plant at the base of the stems and gently slide it out. Tap the pot if it sticks.
4. Look at the roots. Are they white and healthy? Are they circling? Draw what you see.
5. Gently loosen the circling roots with your fingers.
6. Put potting mix in the bottom of the new pot so the plant will sit at the same depth as before, about an inch below the rim.
7. Set the plant in the middle. Fill in around it with fresh mix, pressing gently. Do not bury the stems deeper than before.
8. Water slowly until water drips out the bottom. Set the plant in bright light out of hot sun for a week.

Tips

- If you have no plant to repot, ask a neighbor or church if they have one that needs help.
- A spider plant makes baby plants on long stems. You can pot the babies in small cups and give them away.

Check your work

- ☐ I checked the roots and can tell if the plant was root-bound.
- ☐ I used a pot only a little bigger with a drainage hole.
- ☐ I set the plant at the same depth and watered it well.

NATURE JOURNAL

1. Draw the roots as you found them when you slid the plant out.
2. Draw the plant before and after repotting. Write the size of the old pot and the new one.
3. Keep a two-week log: does the plant droop at first? When do you see new leaves?

COMMON MISTAKES

- Using a pot that is much too big. Go up only one or two inches.
- Using a pretty pot with no drainage hole. Roots sitting in water will rot.

Make it a game • Repot or Wait?. Your grown-up describes a plant: roots poking out the bottom, water running straight through, the plant tipping over. Decide repot or wait, and say why. Then choose from three pot sizes and explain why only a little bigger is best. Check each pot for a drainage hole. Score your answers.

7.2 A WINDOWSILL HERB GARDEN

OBJECTIVES

- Name several easy herbs and how they are used.
- Plant herbs from seeds or small plants in pots on a sunny windowsill.
- Water and harvest herbs the right way so they keep growing.

Warm-up. Smell four herbs or spices with your eyes closed: mint, basil, parsley and dried oregano (or whatever you have). Can you guess which is which? Which smell reminds you of a food?

WATCH

10 Herbs You Can Grow Indoors on Kitchen Counter

Daisy Creek Farms with Jag Singh • 4:53

<https://www.youtube.com/watch?v=DeLjnFTDjFc>

WHEN TO WATCH

After the warm-up. Choose two or three of the herbs shown for your windowsill.

BACKUP VIDEO

Kitchen Windowsill Herbs - Martha Stewart

Martha Stewart • 3:03

<https://www.youtube.com/watch?v=enycLJI9XKM>

Before the hands-on project, to see herbs potted up for a kitchen window.

KEY TERMS

herb

A plant whose leaves, seeds or flowers are used to flavor food or for their smell, like basil, parsley, mint and chives.

annual

A plant that grows, flowers, makes seeds and dies in one year, like basil.

perennial

A plant that lives for many years, like mint, chives, thyme and oregano.

pinch

To snip off the top tip of a stem so the plant grows bushier.

CORE IDEAS

Herbs are some of the easiest plants to grow, and they make food taste wonderful. Many grow happily in pots on a sunny windowsill, even in the middle of a city.

Easy herbs to start with: **basil** (for tomatoes and pizza; it loves warmth and hates cold), **parsley** (curly or flat leaves, full of vitamins), **chives** (thin, grassy leaves that taste like mild onions), **mint** (for tea; it spreads fast, so keep it in its own pot), **thyme** and **oregano** (tiny leaves full of flavor).

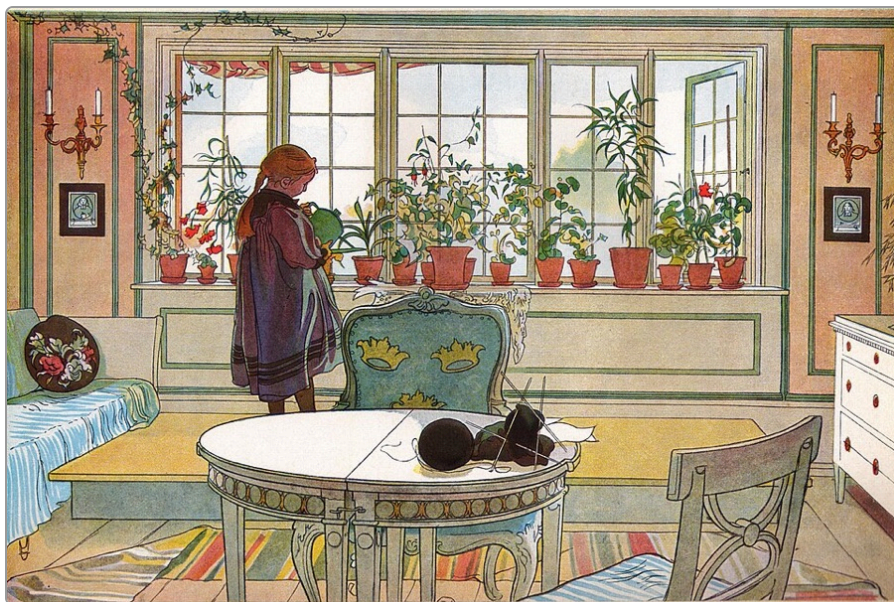
Herbs need a lot of light: a south- or west-facing window that gets at least six hours of sun is best. Plant them in pots with drainage holes and fresh potting mix. Let the top of the soil dry a little between waterings, then water well until water comes out the bottom. Empty the saucer so roots do not sit in water.

To harvest, snip leaves from the top, just above a pair of leaves. This is called **pinching**, and it makes the plant branch out and grow bushier. Never take more than one third of the plant at a time. Pinch off flower buds on basil so it keeps making leaves.

Some herbs are **annuals** that live one season, like basil. Others are **perennials** that come back year after year, like mint, chives, thyme and oregano. In summer, many windowsill herbs can move outside to a sunny porch.

Long ago, every family kept a kitchen garden of herbs for cooking and comfort. When you snip fresh herbs for supper, you are keeping up a very old and useful habit.

PICTURE STUDY



The Flower Window, Carl Larsson, 1894 · Watercolor · Nationalmuseum, Stockholm

Image: [Wikimedia Commons](#), public domain

Carl Larsson painted his family's happy life in a little red cottage in Sweden. Swedish winters are long and dark, so families filled their sunny windows with potted plants. This watercolor shows a window full of growing things.

Look closely

- Count the pots on the windowsill.
- Find where the light comes from. Why are all the plants by the window?
- Look at the pots. Are they all the same size?
- Find someone caring for the plants. What are they doing?

Talk about it

1. Why do plants in a house grow best near a window?
2. Which herbs would you put in a window like this?
3. How would you keep the plants in this window from drying out?

Safety first. Use scissors with care and a grown-up's permission. Wash herbs before eating, and eat only plants a grown-up says are safe.

HANDS-ON PROJECT

Plant a Windowsill Herb Garden

You will plant three herbs in pots on a sunny windowsill, care for them, and harvest some for a family meal.

You will need

- Three small pots (4 to 6 inches) with drainage holes and saucers, or a long window box
- Potting mix
- Herb seeds (basil, parsley, chives) or small herb plants from a garden center
- Plant labels
- A spray bottle and a small watering can
- Small scissors
- A sunny window

Steps

1. Choose your sunniest window. Check it at different times of day to see how many hours of sun it gets.
2. Fill each pot with damp potting mix to an inch below the rim.
3. Seeds: sprinkle a few seeds on top, cover lightly as the packet says, and mist gently. Plants: dig a small hole, slip the plant out of its pot, set it in at the same depth, and press the soil around it.
4. Label each pot with the herb's name and the date.
5. Set the pots on saucers in the window. Keep seeds damp until they sprout; water plants when the top inch of soil feels dry.
6. Turn the pots a little every few days so the herbs do not lean toward the light.
7. When the herbs are about 6 inches tall, pinch off the tips just above a pair of leaves. Use your harvest in a family meal.
8. Keep a log of watering and harvesting for three weeks.

Tips

- Basil seeds sprout in about a week. Parsley is slow and can take two or three weeks, so be patient.
- Herbs from the grocery store in pots can be divided into several smaller plants.
- A healthy, bushy potted herb is a classic fair exhibit. Judges look for a clean pot, healthy leaves with no yellowing or bugs, a plant that fits its pot, and a neat label with the plant's name. Check your county fair book for the youth potted-plant class.
- Pot up an extra herb or two as a gift for a neighbor, an elderly friend or your church kitchen. Add a label with care directions.

Check your work

- ☐ I planted and labeled three herbs.
- ☐ I can pinch an herb the right way to make it bushy.
- ☐ I used my herbs in a family meal.

NATURE JOURNAL

1. Draw a leaf from each herb, life-sized. Smell it and write a word for its smell.
2. Keep a watering and growth log for your herbs.
3. Draw a plate of food and show which herb you would add to it.
4. Keep a project record: planting date, what the seeds, pots and soil cost, how often you watered, the height each week, and one thing you learned.

COMMON MISTAKES

- Putting herbs in a dim corner. They need a bright, sunny window.
- Cutting a plant down to the soil. Take only the top third so it can keep growing.

Make it a game • Herb Smell and Name. Close your eyes while your grown-up holds an herb like mint, basil or parsley under your nose. Guess the herb and say one way people use it. Then say what pinching does to a plant. Count how many herbs you can name from memory, and the ones you know are annuals.

7.3 RAISED BEDS

OBJECTIVES

- Tell why many gardeners grow in raised beds.
- Name what goes in a raised bed and how to fill it.
- Plan and plant a raised bed or a large container garden.

Warm-up. Push a pencil into hard, packed dirt in the yard, and then into a pot of fluffy potting mix. Which is easier? Which would a carrot root rather grow through?

WATCH

How to Build Cheap, DIY Raised Garden Beds In Under 30 Minutes

Epic Gardening • 3:13

<https://www.youtube.com/watch?v=PLyi95Umebk>

WHEN TO WATCH

After the core ideas. Notice the tools the grown-ups use and how the corners go together.

BACKUP VIDEO

Easy DIY 3 Ingredient Raised Bed Soil Recipe & How to Fill it Using Less Soil

CaliKim Garden & Home • 7:41

<https://www.youtube.com/watch?v=CP1B6o-dQiM>

Before filling your bed. Listen for the three ingredients.

KEY TERMS

raised bed

A garden bed built up above the ground, often with wooden or metal sides, and filled with good soil.

drainage

How well water flows down through soil. Raised beds drain well, so roots do not sit in soggy soil.

spacing

How far apart plants should be planted so each has room to grow.

path

A walkway between beds, so gardeners never step on the growing soil and pack it down.

CORE IDEAS

A **raised bed** is a garden box built on top of the ground, usually 6 to 12 inches tall or more, and filled with rich soil. Gardeners have used raised beds for hundreds of years.

Raised beds have many good points. The soil warms up faster in spring, so you can plant sooner. Extra rain drains away, so roots do not drown. You fill them with good soil, so you do not have to fight hard clay or rocky ground. And because you walk on the **paths**, not in the bed, the soil stays loose and fluffy for roots.

Make beds no wider than 4 feet, so you can reach the middle from both sides without stepping in. Put them where they get at least six to eight hours of sun. Wood, metal, stone or bricks can make the sides. A bed can sit right on the grass if you lay cardboard on the bottom first to smother the grass.

Fill the bed with a mix of good garden soil or topsoil and plenty of compost. Many gardeners use about half topsoil and half compost. This makes dark, crumbly soil full of food for plants.

Plant with the right **spacing**. The seed packet tells how far apart to plant. Tall plants like tomatoes go on the north side so they do not shade short plants. Then water deeply and add mulch (straw or shredded leaves) to keep the soil moist.

A raised bed can grow a surprising amount of food in a small space. Even a big container, a grow bag or a half-barrel on a patio works like a small raised bed.

PICTURE STUDY



The Gardeners, Gustave Caillebotte, 1875–1877 • Oil on canvas • Private collection

Image: [Wikimedia Commons](#), public domain

Gustave Caillebotte's family had a large country house with a big kitchen garden. He painted the gardeners at work watering long, straight beds of vegetables. Look how neat and orderly the beds and paths are.

Look closely

- Find the watering cans. How are the gardeners carrying them?
- Look at the beds. Are they long and narrow or wide? Why would that help?
- Find the paths between the beds. Why don't the gardeners walk on the beds?
- Find the round glass covers on some plants. What might they be for?

Talk about it

1. Why do you think the gardeners water at the base of the plants?
2. How is this garden like a raised bed garden?
3. What vegetables do you think are growing here?

Safety first. Grown-ups use the saw, drill and other building tools. Wear gloves when moving wood, soil and compost, and wash your hands afterward. Lift with your legs, not your back, and carry only what is easy for you.

HANDS-ON PROJECT

Plan and Plant a Raised Bed (or Big Container)

You will help your family build or fill a raised bed, or fill a large container, and plant it with a plan you drew yourself.

You will need

- A raised bed kit or boards and screws (grown-up builds), or a large container or grow bag at least 12 inches deep
- Cardboard (for the bottom of a bed on grass)
- Topsoil or garden soil and compost (about half and half)
- Seeds or small plants: for example lettuce, radishes, carrots, bush beans, a tomato and marigolds
- Graph paper and colored pencils
- A tape measure
- A watering can and straw or shredded leaves for mulch

Steps

1. Choose a sunny spot. Watch it at morning, noon and afternoon to be sure it gets six or more hours of sun.
2. Measure the bed. On graph paper, let one square equal one foot. Draw the bed and mark north.
3. Plan where each plant will go. Put tall plants on the north side. Check each seed packet for spacing and draw circles for each plant.
4. If the bed sits on grass, lay cardboard on the bottom and wet it.
5. Help fill the bed with soil and compost. Mix them with a trowel or shovel. Water the soil so it settles.
6. Plant seeds and seedlings following your plan. Label each row or square.
7. Water gently. When seedlings are a few inches tall, spread mulch around them.
8. Hang your plan in the kitchen and check off each plant as it comes up.

Tips

- Plant only cool-season crops before your last frost date, and add warm-season crops like tomatoes and beans after.
- A square-foot plan with string grids makes spacing easy.

Check your work

- ☐ My plan shows where each plant goes, with tall plants on the north side.
- ☐ I can name two reasons raised beds help plants grow.
- ☐ I planted following my plan and labeled the plants.

NATURE JOURNAL

1. Draw your raised bed plan from above, with each plant labeled.
2. Draw a cut-away of a raised bed: the sides, cardboard on the bottom, the soil and compost, and roots growing down.
3. Start a raised-bed log: planting date, first sprouts, and weather.

From history. In 1577, an Englishman named Thomas Hill wrote one of the first English books about gardening, *The Gardener's Labyrinth*. Its woodcut pictures show raised beds with wooden edges and paths between them, just like many gardens today.

COMMON MISTAKES

- Making the bed too wide to reach the middle.
- Planting tall tomatoes on the south side where they shade everything else.

Make it a game • Raised Bed Fill-In. Draw a raised bed from above with a path around it. Your grown-up calls out jobs and you add them: good soil, drainage, spacing, plant names. Explain why gardeners like raised beds. Then stand in your bed and say which plants fit into each square. Try to plan one with no repeats.

7.4 PLANTING A FRUIT TREE OR BERRY BUSH

OBJECTIVES

- Tell how a fruit tree or berry bush grows and how long it takes to bear fruit.
- Plant a tree or bush at the right depth and water it deeply.
- Make a care plan for the first year.

Warm-up. Look at an apple, a handful of blueberries or a strawberry. Count the seeds. Ask: “Do farmers plant apple orchards from seeds?” (Usually not; they plant young trees grafted from good varieties.) Talk about how long you think a tree takes to make fruit.

WATCH

How to Plant a Fruit Tree - Essential Steps

GrowVeg • 5:50

<https://www.youtube.com/watch?v=7EbJP9R7WKg>

WHEN TO WATCH

Before the hands-on project. Pause at each step and say it back: dig, loosen, set the depth, fill, water, mulch.

BACKUP VIDEO

Planting Blueberries

The University of Maine • 6:00

<https://www.youtube.com/watch?v=XarFNbN04Io>

If you are planting blueberries or another berry bush instead of a tree.

KEY TERMS

orchard

A field of fruit trees, such as apples, pears, peaches or cherries.

root flare

The place at the bottom of a tree trunk where it widens into roots. It should sit at or just above the soil line.

perennial

A plant that lives for many years. Fruit trees and berry bushes are perennials.

mulch

A layer of wood chips, straw or leaves spread on top of the soil to keep in moisture and keep weeds down.

pollination

Moving pollen from flower to flower,
often by bees, so fruit can form.

CORE IDEAS

A vegetable garden is planted again every year, but a fruit tree or berry bush is a **perennial** that can bear fruit for many years. Blueberry bushes can live and fruit for decades. An apple tree planted today might still bear apples when you are a grandparent.

Fruit takes patience. A young blueberry bush may give a few berries in two or three years. A dwarf apple tree may take three to five years to bear well. Strawberries are quicker, often fruiting the year after planting. In the Bible, God told Israel to wait several years before eating from a new fruit tree, so it could grow strong.

Most fruit trees need full sun, soil that drains well, and room to grow. Many apples and pears need a second variety nearby so bees can carry pollen between them; this is called **pollination**. Blueberries need acid soil, so gardeners often mix in peat or plant them in pots.

To plant: dig a hole two or three times as wide as the roots but only as deep as the root ball. Loosen circling roots. Set the plant so the **root flare** (where the trunk widens) sits at or slightly above the soil, never buried. Fill the hole with the same soil you dug out, firm it gently, and water slowly and deeply.

Spread a ring of **mulch** around the plant, keeping it a few inches away from the trunk. Water deeply once or twice a week the first year, unless it rains. Protect young trees from deer and rabbits with a wire cage if needed.

Planting a tree is a gift to the future. Jesus told about a gardener who asked for one more year to dig around a fig tree and feed it so it would bear fruit. Patient, faithful care is what fruit trees need.

PICTURE STUDY



Orchard in Bloom, Louveciennes, Camille Pissarro, 1872 · Oil on canvas · National Gallery of Art, Washington

Image: [Wikimedia Commons](#), public domain

Camille Pissarro painted this orchard in spring, when the fruit trees were covered in blossoms. Each blossom, if a bee visits it, can become a fruit by autumn. Look for the people at work in the orchard.

Look closely

- Find the trees in bloom. What colors are the blossoms?
- Find the people. What might they be doing in the orchard in spring?
- Look at the ground under the trees. Is it bare soil or grass?
- Look at how far apart the trees are planted.

Talk about it

1. What needs to happen for these blossoms to become fruit?
2. Why are fruit trees planted far apart?
3. What would this orchard look like in the fall?

Safety first. A grown-up uses the shovel for most of the digging. Wear gloves and sturdy shoes. Call 811 before digging a deep hole in the yard so buried lines are marked.

HANDS-ON PROJECT

Plant a Fruit Tree, Berry Bush or Strawberry Pot

You will help plant a fruit tree or berry bush in the yard, or plant strawberries or a dwarf blueberry in a large pot, and make a first-year care plan.

You will need

- A young fruit tree, a berry bush (blueberry, raspberry) or 3 to 5 strawberry plants
- A shovel (grown-up) and a trowel
- A large pot (at least 18 inches wide) with drainage holes and potting mix, for a container
- Compost
- Mulch (wood chips or straw)
- A watering can or hose
- A tape measure
- A tag to label the plant

Steps

1. Choose a sunny spot with room for the plant to grow. Check the tag for how big it will get.
2. A grown-up digs a hole two or three times as wide as the roots and just as deep. You can loosen the soil at the sides with a trowel.
3. Slide the plant out of its pot. Gently loosen any circling roots.
4. Set the plant in the hole. Lay a stick across the hole to check that the root flare is level with the ground or slightly above.
5. Fill the hole back in with the soil you dug out, mixed with a little compost. Press it gently with your hands.
6. Water slowly until the soil is soaked. Then spread mulch in a ring, keeping it a few inches away from the trunk.
7. Container version: fill a big pot with potting mix (for blueberries, use a mix made for acid-loving plants), plant at the same depth, and water well.

8. Make a first-year care plan: water deeply once a week if no rain, pull weeds in the mulch ring, watch for pests, and be patient for fruit.

Tips

- Plant trees in early spring or fall, when the weather is cool and roots can settle in.
- Pick off strawberry flowers the first few weeks so the plants grow strong roots.

Check your work

- ☐ I set the plant at the right depth, not too deep.
- ☐ I watered deeply and added mulch, not touching the trunk.
- ☐ I can tell how long my plant may take to bear fruit.

NATURE JOURNAL

1. Draw your tree or bush the day you planted it. Write the date and its height.
2. Draw a cut-away of the planting hole: wide and shallow, with the root flare at the soil line and mulch on top.
3. Draw a fruit tree in four seasons: blossoms in spring, green fruit in summer, ripe fruit in fall, bare branches in winter.

COMMON MISTAKES

- Planting too deep. The root flare should be at or above the soil line.
- Piling mulch against the trunk like a volcano. Keep it a few inches away.

Make it a game • Fruit Tree Planting Order. Write the planting steps on cards: dig a wide hole, find the root flare, set the tree at the right depth, fill and water deeply, add mulch. Shuffle them. Put them in order against a timer. Then say how long it takes for a tree or bush to bear fruit.

Scripture. “And he answering said unto him, Lord, let it alone this year also, till I shall dig about it, and dung it:” (Luke 13:8, KJV)

In Jesus’ story, the gardener wanted to give the fig tree one more year of digging and feeding. Fruit trees teach us patience, and God is patient with us too.

UNIT 7

PLANTING

Spring is planting time. In this unit your child learns where and how to plant: repotting a houseplant that has outgrown its pot, starting a windowsill herb garden, building and filling a raised bed, and planting a fruit tree or berry bush that may bear fruit for many years. Every lesson ends with something real growing.

Families without a yard can do every lesson with pots: a houseplant, a windowsill of herbs, a large container or grow bag in place of a raised bed, and a pot of strawberries or a dwarf blueberry on a balcony. Our pictures show gardens painted by Claude Monet, Carl Larsson, Gustave Caillebotte and Camille Pissarro.

PREREQUISITES

- Knows what plants need: light, water, warmth, air and nutrients
- Has planted seeds in a pot
- Knows the last frost date for your area (from Unit 5)

MASTERY CHECKLIST

- ☐ I can tell when a plant needs a bigger pot and repot it gently.
- ☐ I can grow at least three herbs on a sunny windowsill and harvest them the right way.
- ☐ I can tell why raised beds are useful and what goes inside them.
- ☐ I can plant a tree or bush at the right depth and water it well.
- ☐ I can make a planting plan that puts each plant where it will grow best.

LESSONS IN THIS UNIT

7.1 Repotting a Houseplant

2 sessions of 30–40 minutes

7.2 A Windowsill Herb Garden

2 sessions of 30–40 minutes

7.3 Raised Beds

2 sessions of 30–40 minutes

7.4 Planting a Fruit Tree or Berry Bush

2 sessions of 30–40 minutes

UNIT 7 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing, or showing a plant. There are no points; listen for understanding.

1. Name two signs that a houseplant needs a bigger pot.
2. Why must every pot have a drainage hole?
3. Show me how to harvest herbs so they keep growing.
4. Tell me two reasons gardeners like raised beds.
5. When you plant a tree, how deep should it go?
6. Why does a gardener need patience with a fruit tree?

ANSWER KEY

1. Any two: roots coming out of the drainage hole, roots circling in a tight web, water running straight through, soil drying very fast, the plant tipping over.
2. So extra water can run out; roots sitting in water rot.
3. Pinch or snip from the top just above a pair of leaves, and take no more than a third of the plant.
4. Any two: soil warms faster, drains well, can be filled with good soil, stays loose because no one steps on it, easier to reach.
5. Only as deep as the root ball, with the root flare at or slightly above the soil line.
6. It may take several years to bear fruit, and it needs faithful watering and care until then.

PORTFOLIO PIECE: MY SPRING PLANTING MAP

Make a map of everything you planted this unit: the repotted houseplant, the windowsill herbs, the raised bed or container, and the fruit tree, bush or strawberries. Draw each one where it grows (in the house, by the window, in the yard), label it with the planting date, and add a photo or drawing of each. Keep watering everything for at least three weeks and add notes about how each plant is doing.

LOOK FOR	WHAT IT MEANS
Planting	Planted or repotted at least three things from this unit with grown-up help.
Right place	Can explain why each plant was put where it is (sun, drainage, room to grow).
Faithful care	Watered and checked the plants without reminders for three weeks.
Map and records	The map is labeled with plants, dates and notes.

UNIT 8

PLANT HEALTH

As the garden grows, so do its visitors. In this unit your child learns to tell good bugs from bad bugs, deals with slugs, snails and caterpillars by hand-picking and simple traps, meets the fungi that help plants and the fungi that make them sick, and becomes a garden detective who can look at a sick plant and figure out what is wrong.

We never use sprays or poisons in this course. Instead we use the gardener's best tools: sharp eyes, clean hands, healthy soil, good spacing, the right amount of water, and the help of ladybugs, birds and toads. Our pictures are Albrecht Dürer's stag beetle, a caterpillar study by Maria Sibylla Merian, Robert Hooke's view of mold through a microscope, and a flower painting by Rachel Ruysch full of tiny creatures to find.

PREREQUISITES

- Has plants growing (from Unit 7, or any garden or pot)
- Can use a magnifying glass
- Knows that plants need light, water and nutrients

MASTERY CHECKLIST

- ☐ I can name three helpful garden insects and three harmful ones.
- ☐ I can hand-pick or trap slugs, snails and caterpillars without poisons.
- ☐ I can tell one way fungi help plants and one way fungi make plants sick.
- ☐ I can look at a sick plant and check for water, light, pests and disease.
- ☐ I can keep a garden-detective log with dates and drawings.

LESSONS IN THIS UNIT

8.1 Good Bugs and Bad Bugs

2 sessions of 30–40 minutes

8.2 Slugs, Snails and Caterpillars

2 sessions of 30–40 minutes

8.3 Fungi That Help and Fungi That Harm

2 sessions of 30–40 minutes

8.4 Garden Detective: What's Wrong with My Plant?

2 sessions of 30–40 minutes

UNIT 8 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing, or showing a real plant or bug. There are no points; listen for careful thinking.

1. Name two helpful garden insects and two pests.
2. A leaf has ragged holes and a shiny silver trail. Who did it, and what can you do without poison?
3. Tell me the four stages in a moth's or butterfly's life.
4. Tell me one way fungi help and one way they harm plants.
5. What is the rule about wild mushrooms?
6. A plant's leaves are yellow and drooping. What is the first thing you check, and why?

ANSWER KEY

1. Helpers: ladybugs, lacewings, bees, ground beetles, praying mantises. Pests: aphids, cabbage worms, tomato hornworms, squash bugs, Japanese beetles.
2. A slug or snail. Hand-pick in the evening or morning, set a board or pot trap, and water in the morning instead of at night.
3. Egg, caterpillar (larva), pupa, adult.
4. Help: break down dead leaves and wood into humus, or help roots get water and minerals. Harm: powdery mildew, damping off, leaf spots, blight, gray mold.
5. Never eat or taste a wild mushroom; some are deadly. Look but do not touch.
6. Feel the soil: it may be too wet (overwatered) or too dry (underwatered). Check before watering.

PORTFOLIO PIECE: MY HEALTHY GARDEN GUIDE

Make a small field guide for your family’s garden or pots. Include drawings of three helper insects and three pests you found, your slug-trap or pest-patrol chart, your spore print or mold-garden drawings, and your garden detective case file. End with a page called “How I Keep My Garden Healthy” listing five habits, such as watering in the morning and looking under leaves.

A neat guide like this can also become an educational poster or journal exhibit at a county fair or a 4-H Cloverbud show-and-tell; check your fair book for youth poster classes.

LOOK FOR	WHAT IT MEANS
Bugs	Drew and named at least three helpers and three pests from real observation.
Pest control without poison	Used hand-picking, traps or barriers and kept a record for at least a week.
Fungi	Can explain one helpful and one harmful fungus and why wild mushrooms are never eaten.
Detective work	Completed a case file, following the steps and checking results over a week.

8.1 GOOD BUGS AND BAD BUGS

OBJECTIVES

- Name helpful insects (ladybugs, lacewings, bees, ground beetles) and harmful ones (aphids, cabbage worms, squash bugs, hornworms).
- Tell how helpful insects eat pests or pollinate flowers.
- Go on a bug hunt and sort the bugs you find.

Warm-up. Look at a picture of a ladybug, a young ladybug larva and an aphid. Which one do you think eats the others? (The ladybug larva looks like a tiny spiky alligator, and it can eat dozens of aphids a day!)

WATCH

Lady Bugs - The Beneficial Insect

UF IFAS Extension • 1:59

<https://www.youtube.com/watch?v=7ZbSAQ3xscE>

WHEN TO WATCH

After the warm-up. Watch for the ladybug's life stages.

BACKUP VIDEO

Beneficial Insects You Want in your Garden - The Gardener's Best Friends!

California Gardening • 3:33

<https://www.youtube.com/watch?v=YkMaZqfHMHc>

After the core ideas. Pause on each helper insect and add it to your chart.

KEY TERMS

beneficial insect

A helpful insect that eats pests or pollinates flowers, like a ladybug, lacewing or bee.

aphid

A tiny, soft insect that sucks juice from leaves and stems, often in crowds on new growth.

pest

An insect or animal that harms crops by eating or damaging them.

larva

The young, wormlike stage of an insect, like a caterpillar or a ladybug larva.

predator insect

An insect that hunts and eats other insects.

CORE IDEAS

Most insects in a garden do no harm, and many are a gardener's friends. Only a few are pests. Learning which is which is the first job of a garden detective.

Beneficial insects help in two ways. Some are pollinators: bees, butterflies and hover flies carry pollen so squash, apples and berries can form. Others are predators that eat pests. **Ladybugs** and their spiky young (**larvae**) eat aphids by the dozen. **Green lacewing** larvae are called "aphid lions." **Ground beetles** hunt slugs and cutworms at night. Praying mantises and spiders catch many insects too.

Pests eat or damage our plants. **Aphids** are tiny, soft, green or black insects that crowd on new leaves and suck the juice, making leaves curl. **Cabbage worms** are velvety green caterpillars that chew holes in cabbage, kale and broccoli. **Tomato hornworms** are huge green caterpillars with a horn on their tail that can strip a tomato plant. **Squash bugs** and **Japanese beetles** damage squash and roses.

Do not squash every bug you see! First look closely and find out who it is. A ladybug larva looks strange, but it is a helper. If you spray poison, you kill the helpers along with the pests, and the pests often come back faster.

To invite helpers, plant flowers among your vegetables: marigolds, zinnias, dill, sweet alyssum and herbs. Leave a shallow dish of water with stones in it, and do not use sprays. Birds and toads are helpers too.

God made every creature with a purpose. In a healthy garden, helpers and pests keep each other in balance, and the gardener's job is to watch carefully and help the balance along.

PICTURE STUDY



Stag Beetle, Albrecht Dürer, 1505 · Watercolor and gouache on paper · J. Paul Getty Museum, Los Angeles

Image: [Wikimedia Commons](#), public domain

More than five hundred years ago, Albrecht Dürer painted this stag beetle so carefully that it almost seems to crawl off the page. In his day, few artists thought a beetle worth painting. Dürer looked at God's smallest creatures with great attention.

Look closely

- Count the beetle's legs. Is it an insect? (Insects have six legs.)
- Find the big jaws. What do they look like? (They give the stag beetle its name.)
- Find the antennae, the feelers on its head.
- Look at the shadow under the beetle. How does it make the beetle look real?

Talk about it

1. Stag beetle larvae eat rotting wood. Is that helpful or harmful to a garden?
2. Why is it important to look closely at a bug before deciding if it is good or bad?
3. What insect would you paint as carefully as Dürer did?

Safety first. Look with your eyes and a magnifying glass, and use a bug jar or a leaf to move insects. Do not touch bees, wasps or fuzzy caterpillars, which can sting or irritate skin. Wash your hands after bug hunting.

HANDS-ON PROJECT

Garden Bug Hunt and Sorting Chart

You will hunt for insects in a garden, park or pots, look at them closely, and sort them into helpers, pests and “not sure yet.”

You will need

- A magnifying glass
- A clear bug jar with air holes, or a clear cup and a card
- A white sheet of paper or tray
- A notebook and colored pencils
- An insect guide book or printed chart of garden insects
- A large sheet of paper for a chart

Steps

1. Make a chart with three columns: Helpers, Pests, Not Sure Yet.
2. Go to a garden, a weedy edge of a park, or your own plants. Look on the tops and undersides of leaves, on flowers, and under boards or stones.
3. Gently tap a plant over a white paper to see what falls off.
4. When you find a bug, look closely with the magnifying glass. Count its legs. Look at its color, shape and what it is doing.
5. Use your guide to name it. Draw it in the right column of your chart.
6. If you find aphids, look for ladybugs or their larvae nearby.
7. Put every bug back where you found it.
8. Plant a few flower seeds (marigolds, zinnias or sweet alyssum) near your vegetables to invite helpers.

Tips

- Early morning and evening are good times to find bugs.
- A bug that is eating a leaf is probably a pest; a bug that is eating another bug is probably a helper.

Check your work

- ☐ I found and drew at least five bugs.

- ☐ I can name three helpers and three pests.
- ☐ I put every bug back gently.

NATURE JOURNAL

1. Draw the four stages of a ladybug's life: egg, larva, pupa and adult.
2. Draw one helper and one pest you found, very large, and label their parts: head, body, six legs, antennae, wings.
3. Write where you found the most bugs and what they were doing.

COMMON MISTAKES

- Squashing a ladybug larva because it looks strange. It is one of the best helpers.
- Thinking every bug is a pest. Most are harmless or helpful.

Make it a game · Good Bug Bad Bug Toss. Draw two baskets labeled good and bad. Toss a soft paper ball or crumpled paper bug into the right basket when your grown-up names it: ladybug, aphid, lacewing, cabbage worm, ground beetle, hornworm. Say what each one does. Aim for ten points in a row.

Scripture. “But ask now the beasts, and they shall teach thee; and the fowls of the air, and they shall tell thee:” (Job 12:7, KJV)

Job said that even the creatures can teach us about God. Every ladybug and beetle we study closely shows the wisdom of the One who made it.

8.2 SLUGS, SNAILS AND CATERPILLARS

OBJECTIVES

- Identify slug, snail and caterpillar damage on leaves.
- Tell the life cycle of a moth or butterfly: egg, caterpillar, pupa, adult.
- Control pests by hand-picking, traps and barriers, without poisons.

Warm-up. Look at three damaged leaves (or pictures): one with ragged holes and a shiny, silvery trail; one with neat round holes and tiny green droppings; one with curled, sticky leaves. Guess who did each: a slug, a caterpillar, or aphids.

WATCH

The Ultimate Chemical Free Slug & Snail Garden Trap: 2 Clay Pots Equals Crazy Results!

Gary Pilarchik (The Rusted Garden) · 3:01

<https://www.youtube.com/watch?v=rhkiiQ-qLxM>

WHEN TO WATCH

Before the hands-on project. Watch how the clay-pot trap is set up and checked in the morning.

BACKUP VIDEO

5 Tips for Controlling Cabbage Moths & Worms

Audrey's Little Farm · 2:56

<https://www.youtube.com/watch?v=Du6dt3D9eUY>

For the caterpillar part of the lesson. Listen for the netting and hand-picking tips.

KEY TERMS

slug

A soft, slimy animal with no shell that eats leaves at night and leaves a shiny trail.

snail

An animal like a slug, but with a coiled shell on its back.

caterpillar

The young (larva) of a butterfly or moth. It eats leaves and grows fast.

pupa

The resting stage when a caterpillar changes into a butterfly or moth, inside a chrysalis or cocoon.

barrier

Something that blocks pests from reaching plants, like a net, collar or copper strip.

CORE IDEAS

Slugs and **snails** are not insects. They are soft-bodied animals that glide on one muscular foot over a carpet of slime. They hide in damp, shady places in the day and come out at night or on rainy days to eat. They love young lettuce, beans, strawberries and hostas. Their clues are ragged holes and silvery slime trails.

Caterpillars are the young of butterflies and moths. A moth or butterfly lays tiny eggs on a leaf. The eggs hatch into caterpillars, which eat and grow quickly. Then each one rests as a **pupa** and changes into a winged adult. This change is called metamorphosis. Most caterpillars do little harm, but a few, like cabbage worms and tomato hornworms, can eat a lot of a crop. Their clues are holes in leaves and little dark droppings.

The best control is **hand-picking**. Go out in the early morning or evening with gloves and a jar, look under leaves, and pick off slugs, snails and pest caterpillars. Look for clusters of tiny eggs under leaves and wipe them off. Feed what you collect to chickens if you have them, or move them far from the garden.

Traps and **barriers** help too. A board, a clay pot or a grapefruit rind laid on damp soil makes a cool hiding place; slugs crawl under it at night, and you collect them in the morning. A light net or row cover over cabbage keeps butterflies from laying eggs. Water in the morning, not at night, so the soil surface is drier when slugs come out.

Wait before you pick every caterpillar. Learn its name first. The striped caterpillar on dill or parsley may become a beautiful black swallowtail butterfly, and monarch caterpillars eat only milkweed. A wise gardener can share a little.

Birds, toads, ground beetles and garter snakes eat slugs and caterpillars. A garden with places for these helpers to live needs less work from the gardener.

PICTURE STUDY



Metamorphosis of the Emperor Moth, Maria Sibylla Merian, about 1680s · Watercolor and gouache on vellum · Rijksmuseum, Amsterdam

Image: [Wikimedia Commons](#), public domain

Maria Sibylla Merian was a German artist and naturalist who raised caterpillars at home to watch them change. In her day, many people thought insects simply appeared out of mud. Merian's careful paintings showed each stage: egg, caterpillar, pupa and moth, all on the very plant the caterpillar eats.

Look closely

- Find the caterpillar. What plant is it on?
- Find the cocoon or pupa. Which stage comes before it, and which comes after?
- Find the moth. Look at the round spots on its wings. What might they look like to a bird?
- Look at the leaves. Can you see any holes where the caterpillar has been eating?

Talk about it

1. Why did Merian paint the caterpillar on its food plant?
2. How can a gardener tell if a caterpillar will become a helpful butterfly or a pest moth?

3. Merian watched one kind of caterpillar for weeks. What could you learn by watching one caterpillar every day?

Safety first. Wear gloves when picking slugs and caterpillars; some fuzzy caterpillars can irritate skin. Never use slug pellets or poisons. Wash your hands with soap afterward.

HANDS-ON PROJECT

A Slug Trap and a Morning Pest Patrol

You will set up a simple slug trap, go on a morning pest patrol, and keep a record of what you catch for one week.

You will need

- A flat board, an upside-down clay pot propped up on one side, or half a grapefruit rind
- Garden gloves
- A jar with a lid
- A flashlight (for an evening look with a grown-up)
- A magnifying glass
- A notebook
- Light netting or row cover (optional)

Steps

1. In the evening, water the soil near your lettuce or strawberries, and lay your board, propped pot or grapefruit rind on the damp soil.
2. With a grown-up, go out after dark with a flashlight. Look for slugs and snails on leaves. Watch how they move.
3. In the morning, lift your trap. Count the slugs and snails hiding underneath and collect them in the jar.
4. Check the undersides of cabbage, kale or broccoli leaves for green caterpillars and tiny yellow or white eggs. Pick them off.
5. Record the date, how many slugs, snails and caterpillars you found, and the weather.
6. Move the collected pests far from the garden, or give them to a neighbor's chickens.
7. Repeat every morning for a week. Is the number going down?
8. If you are growing cabbage-family plants, cover them with light netting to keep butterflies from laying eggs.

Tips

- Slugs are most active after rain and on damp, cloudy days.
- Count the holes on one leaf on day 1 and day 7 to see if your patrol is working.

Check your work

- ☐ I set a slug trap and checked it every morning.
- ☐ I can tell slug damage from caterpillar damage.
- ☐ I can tell the four stages of a moth's life.

NATURE JOURNAL

1. Draw a slug and a snail. Label the eyestalks, foot and shell.
2. Draw the four stages of a butterfly or moth in a circle with arrows: egg, caterpillar, pupa, adult.
3. Make a one-week pest-patrol chart with your counts each day.

From history. In 1699, at the age of 52, Maria Sibylla Merian sailed with her daughter to Suriname in South America to study insects and plants there. Her beautiful book about the insects of Suriname helped scientists understand how caterpillars change into butterflies and moths.

COMMON MISTAKES

- Watering in the evening. Damp soil at night invites slugs.
- Picking every caterpillar. Learn its name first; some become helpful butterflies.

Make it a game • Damage Detective Cards. Draw leaf damage on three cards: ragged holes, slime trails and a chewed edge. Your grown-up picks a card and you say slug, snail or caterpillar and why. Then act out the life cycle: egg, caterpillar, pupa, adult. Shuffle and play three rounds, beating your best score.

8.3 FUNGI THAT HELP AND FUNGI THAT HARM

OBJECTIVES

- Tell that fungi are living things that are not plants or animals: mushrooms, molds, mildews and yeasts.
- Name ways fungi help: breaking down dead things and helping roots find water.
- Name plant diseases caused by fungi, such as powdery mildew and damping off, and how to prevent them.

Warm-up. Look at a mushroom from the grocery store with a magnifying glass. Look under the cap at the thin gills. Gently tap the cap over dark paper. Talk about what the tiny dust (spores) might be for.

WATCH

All About Fungi

Next Generation Science · 3:16

<https://www.youtube.com/watch?v=UCgKHOo0nU4>

WHEN TO WATCH

After the warm-up. Listen for how fungi are different from plants, and watch for the mold on the bread and the fungi breaking down old logs.

BACKUP VIDEO

Powdery Mildew, why it happens, mostly not a worry

Charles Dowding · 4:23

<https://www.youtube.com/watch?v=SaGAlOssmqA>

After the core ideas, to see real powdery mildew on squash leaves in a garden.

KEY TERMS

fungus (plural: fungi)

A living thing that is not a plant or an animal. Mushrooms, molds, mildews and yeasts are fungi. They cannot make their own food from sunlight.

spores

Tiny specks, like dust, that fungi use to spread and grow new fungi.

mycelium

A web of thin, white threads that a fungus grows through soil, wood or leaves.

powdery mildew

A plant disease caused by a fungus that looks like white powder on leaves.

damping off

A disease that makes young seedlings fall over and die at the soil line, often caused by fungi in wet, crowded pots.

CORE IDEAS

Fungi are a group of living things all their own. They are not plants, because they have no green leaves and cannot make food from sunlight. They are not animals either. Mushrooms, molds, mildews and the yeast that makes bread rise are all fungi. Most of a fungus is hidden: a web of thin white threads called **mycelium** spreading through soil or wood. A mushroom is only the part that pops up to make **spores**.

Many fungi are helpers. They are some of the most important decomposers, turning fallen logs and leaves into humus. Some fungi wrap around plant roots and stretch out their threads like extra roots, bringing water and minerals to the plant. In return, the plant gives them sugar. Most garden plants grow better with these root-helping fungi.

Some fungi make plants sick. **Powdery mildew** looks like white flour dusted on squash, cucumber and zinnia leaves, often in late summer. **Damping off** makes baby seedlings suddenly flop over at the soil line. Other fungi cause leaf spots and blights on tomatoes, and gray fuzzy mold on strawberries.

Fungi love damp, still, crowded places. To prevent disease: give plants room so air can move between them, water the soil and not the leaves, water in the morning so leaves dry in the sun, use clean pots and fresh mix for seedlings, and pick off and throw away (not compost) badly sick leaves. Choosing plant varieties that resist disease helps too.

Never eat a wild mushroom. Some are deadly poisonous, and even experts can be fooled. Look, draw and photograph mushrooms, but do not touch or taste them, and wash your hands if you do touch one.

PICTURE STUDY



Blue Mould, from Micrographia, Robert Hooke, 1665 · Engraving from Micrographia · Micrographia, Royal Society, London

Image: [Wikimedia Commons](#), public domain

Robert Hooke was one of the first people to look at tiny things through a microscope and draw what he saw. In his book *Micrographia*, he drew the blue mold that grows on old leather and bread. To his amazement, it looked like a tiny forest of stalks with round heads, each full of spores.

Look closely

- Find the little stalks. What do they remind you of?
- Find the round heads on top. These hold the spores.
- Look at how big Hooke drew them. How small do you think they really are?
- Are there other things on the page? What might they be?

Talk about it

1. Why do you think mold spreads so easily from one piece of bread to another?
2. How is this mold like the powdery mildew on a squash leaf?
3. What would you like to look at under a microscope?

Safety first. Never eat or taste wild mushrooms. Do not sniff moldy food closely, keep the mold bags closed, and let a grown-up throw them away. Wash your hands after handling mushrooms, moldy items or sick leaves.

HANDS-ON PROJECT

Spore Prints and a Mold Garden

You will make a spore print from a store-bought mushroom and grow a safe “mold garden” in a sealed bag to see how fungi grow.

You will need

- Two store-bought mushrooms with open caps (portobello or white button mushrooms with visible gills)
- White and black paper
- A bowl to cover the mushroom
- Three zip bags
- A slice of bread, a piece of fruit and a slice of cheese
- A spray bottle of water
- Tape and a marker
- A magnifying glass

Steps

1. Spore print: a grown-up cuts the stem off a mushroom. Set the cap gills-down on half white, half black paper. Cover it with a bowl and leave it overnight.
2. The next day, lift the bowl and cap carefully. Look at the pattern of spores. Each speck could grow a new fungus. Spray it lightly with hairspray (a grown-up) to keep it.
3. Mold garden: mist the bread, fruit and cheese lightly with water, and put each in its own zip bag. Seal and tape them shut. Label with the date.
4. Put the bags in a warm, dark place. Do not open them.
5. Look at them through the bag every two days with a magnifying glass. Draw what you see: colors, fuzz and spots.
6. After two weeks, a grown-up throws the sealed bags away without opening them.
7. If you have a garden, look for powdery mildew on squash, cucumber or zinnia leaves. Pick off one badly spotted leaf with gloves and throw it in the trash.

Tips

- Damp, warm food molds fastest. Try one dry piece of bread too and compare.
- Mushrooms from the store are safe to handle. Wild ones are not.

Check your work

- ☐ I made a spore print and can tell what spores are for.
- ☐ I can name one way fungi help and one way they harm plants.
- ☐ I can tell two ways to prevent fungus disease in a garden.

NATURE JOURNAL

1. Glue or draw your spore print and label it.
2. Draw your mold garden every two days for two weeks. Write the date and the colors you see.
3. Draw a plant with root-helping fungus threads spreading out from the roots like a web.

COMMON MISTAKES

- Watering leaves at night. Wet leaves overnight invite fungus.
- Putting very sick leaves in the compost. Throw them in the trash so the disease does not spread.

Make it a game • Fungus Fact or Fib. Your grown-up says three facts about fungi, with one tall tale. Spot it. Facts to use: fungi are not plants or animals, mushrooms and molds are fungi, they break down dead things. Then trade and make up your own. Name one way fungi help and one way they harm. Observe mold only from a distance.

Scripture. “I have planted, Apollos watered; but God gave the increase.” (1 Corinthians 3:6, KJV)

Gardeners plant and water, and hidden helpers like fungi and worms work in the soil, but it is God who makes things grow.

8.4 GARDEN DETECTIVE: WHAT'S WRONG WITH MY PLANT?

OBJECTIVES

- Follow detective steps to find out why a plant is unhealthy.
- Tell the clues for too much water, too little water, too little light, hungry soil, pests and disease.
- Choose a gentle fix and check whether it worked.

Warm-up. Play “What’s my problem?” The parent describes a plant: “My leaves are droopy and the soil is dry as dust.” (Too little water.) “My leaves are yellow, and the soil is soggy and smells sour.” (Too much water.) “I am tall, thin and pale, leaning toward the window.” (Too little light.)

WATCH

Guidelines for Diagnosing Plant Problems

UNH Extension · 6:42

<https://www.youtube.com/watch?v=7HnLVYhvars>

WHEN TO WATCH

After the core ideas. Pause after each step and repeat it in your own words.

Note: A slide talk by an extension plant-health specialist, made for adults. Parents may watch first and pause on the photos to talk them through.

KEY TERMS

symptom

A sign that something is wrong, like yellow leaves, holes, spots or wilting.

diagnose

To figure out what is causing a problem by looking at the clues.

overwatering

Giving so much water that roots cannot breathe and begin to rot.

underwatering

Not giving enough water, so the plant wilts and leaves turn crispy.

deficiency

Not having enough of a nutrient, like nitrogen.

CORE IDEAS

When a plant looks sick, a good gardener does not guess. She acts like a detective, gathers clues, and thinks before she acts. The first rule is: **look closely at the whole plant and the place it grows.**

Step 1: Check the water. Push your finger into the soil. Dry as dust and droopy leaves mean **underwatering**. Soggy soil, yellow lower leaves and a sour smell mean **overwatering**; the roots are drowning. Both can make a plant wilt, so always feel the soil before you water.

Step 2: Check the light and temperature. Tall, thin, pale plants leaning to one side need more light. White or brown scorched patches on leaves moved suddenly into hot sun may be sunburn. Black, mushy leaves after a cold night mean frost.

Step 3: Look for pests. Turn leaves over and use your magnifying glass. Holes with slime trails mean slugs. Holes with tiny droppings mean caterpillars. Curled, sticky leaves with crowds of tiny insects mean aphids. Chewed seedlings cut off at the base may mean cutworms or rabbits. Look at the ground too, for footprints or nibbled stems from deer and rabbits.

Step 4: Look for disease and hunger. White powder means powdery mildew. Brown spots with rings, or seedlings falling over, can be fungi. Pale yellow older leaves on a plant that is otherwise fine may mean the soil needs nitrogen; add compost.

Step 5: Choose the gentlest fix and watch. Water deeply or let the soil dry out, move the pot, hand-pick pests, remove sick leaves, add compost. Then check again in a few days and write down what happened. Diligent, patient watching is the gardener's best tool.

PICTURE STUDY



Flowers in a Vase, Rachel Ruysch, about 1700 · Oil on canvas · Fitzwilliam Museum, Cambridge

Image: [Wikimedia Commons](#), public domain

Rachel Ruysch was a Dutch painter who became one of the most famous flower painters of her time and painted into her eighties. Her father was a scientist who collected plants and insects, and she often hid tiny creatures and drooping or damaged leaves in her bouquets. Be a detective and see what you can find.

Look closely

- Find every insect or small creature in the painting. How many can you count?
- Find a leaf or petal that is curled, drooping, torn or has a hole in it.
- Find the freshest flower and a flower that is starting to fade.
- Look at the stems. Are they standing up firm, or bending?

Talk about it

1. If you found a leaf with a hole like the ones in this painting, what clues would you look for next?
2. Why do you think Ruysch painted bugs and damaged leaves instead of making everything perfect?
3. Which flower in the painting would you most like to grow?

Safety first. Wear gloves when handling sick plants, and wash your hands afterward. Never use sprays or chemicals; a grown-up decides on any treatment. Throw diseased leaves in the trash.

HANDS-ON PROJECT

Garden Detective Case File

You will solve a real plant mystery. Choose a plant in your garden or house that looks unhealthy, gather clues step by step, choose a fix, and report what happened.

You will need

- An unhealthy plant (or one of your garden plants to check over)
- A magnifying glass
- A ruler
- Gloves
- A folder or paper for a “case file”
- Colored pencils
- A camera or phone (optional)

Steps

1. Make a case file with the title “The Case of the...” and the plant’s name.
2. Draw or photograph the plant. Describe the symptoms: where are the yellow leaves, holes, spots or droopy parts?
3. Step 1: Feel the soil. Write: dry, damp or soggy.
4. Step 2: Write how much light the plant gets and whether it was hot or cold lately.
5. Step 3: Look under every leaf and on the stems with the magnifying glass. Write down any bugs, eggs, droppings or slime trails.
6. Step 4: Look for powder, spots or rot. Compare with pictures in a garden book or the extension website with a grown-up.
7. Write your diagnosis: “I think the problem is...” and the gentle fix you will try.
8. Try your fix. Check the plant every two days for a week and write what you see. Did it get better? Close the case or try a new idea.

Tips

- Often there is more than one problem. A plant stressed by dry soil is more likely to get pests.
- Your county extension office has Master Gardeners who answer plant questions for free.

Check your work

- ☐ I followed all the detective steps before deciding.
- ☐ I wrote my diagnosis and my fix.
- ☐ I checked the plant for a week and recorded what happened.

NATURE JOURNAL

1. Make a “clue chart”: draw a droopy plant in dry soil, a yellow plant in soggy soil, a pale, leaning plant, a leaf with slug holes, and a leaf with powdery mildew. Label each problem.
2. Draw your case-file plant on day 1 and day 7.
3. Write the five detective steps in your own words.

COMMON MISTAKES

- Watering a wilted plant without checking the soil. It may already be too wet.
- Trying three fixes at once. Try one at a time so you know what worked.

Make it a game • Plant Doctor on Call. Your grown-up calls with a sick plant: yellow, wilting, with holes, pale and stretched. You play doctor and ask two questions, then give a diagnosis and a treatment. Cover too much water, too little water, too little light, hungry soil, pests and disease. Beat your best score of seven correct diagnoses.

UNIT 8

PLANT HEALTH

As the garden grows, so do its visitors. In this unit your child learns to tell good bugs from bad bugs, deals with slugs, snails and caterpillars by hand-picking and simple traps, meets the fungi that help plants and the fungi that make them sick, and becomes a garden detective who can look at a sick plant and figure out what is wrong.

We never use sprays or poisons in this course. Instead we use the gardener's best tools: sharp eyes, clean hands, healthy soil, good spacing, the right amount of water, and the help of ladybugs, birds and toads. Our pictures are Albrecht Dürer's stag beetle, a caterpillar study by Maria Sibylla Merian, Robert Hooke's view of mold through a microscope, and a flower painting by Rachel Ruysch full of tiny creatures to find.

PREREQUISITES

- Has plants growing (from Unit 7, or any garden or pot)
- Can use a magnifying glass
- Knows that plants need light, water and nutrients

MASTERY CHECKLIST

- ☐ I can name three helpful garden insects and three harmful ones.
- ☐ I can hand-pick or trap slugs, snails and caterpillars without poisons.
- ☐ I can tell one way fungi help plants and one way fungi make plants sick.
- ☐ I can look at a sick plant and check for water, light, pests and disease.
- ☐ I can keep a garden-detective log with dates and drawings.

LESSONS IN THIS UNIT

8.1 Good Bugs and Bad Bugs

2 sessions of 30–40 minutes

8.2 Slugs, Snails and Caterpillars

2 sessions of 30–40 minutes

8.3 Fungi That Help and Fungi That Harm

2 sessions of 30–40 minutes

8.4 Garden Detective: What's Wrong with My Plant?

2 sessions of 30–40 minutes

UNIT 8 REVIEW

A parent asks these questions aloud. Your child may answer by telling, pointing, drawing, or showing a real plant or bug. There are no points; listen for careful thinking.

1. Name two helpful garden insects and two pests.
2. A leaf has ragged holes and a shiny silver trail. Who did it, and what can you do without poison?
3. Tell me the four stages in a moth's or butterfly's life.
4. Tell me one way fungi help and one way they harm plants.
5. What is the rule about wild mushrooms?
6. A plant's leaves are yellow and drooping. What is the first thing you check, and why?

ANSWER KEY

1. Helpers: ladybugs, lacewings, bees, ground beetles, praying mantises. Pests: aphids, cabbage worms, tomato hornworms, squash bugs, Japanese beetles.
2. A slug or snail. Hand-pick in the evening or morning, set a board or pot trap, and water in the morning instead of at night.
3. Egg, caterpillar (larva), pupa, adult.
4. Help: break down dead leaves and wood into humus, or help roots get water and minerals. Harm: powdery mildew, damping off, leaf spots, blight, gray mold.
5. Never eat or taste a wild mushroom; some are deadly. Look but do not touch.
6. Feel the soil: it may be too wet (overwatered) or too dry (underwatered). Check before watering.

PORTFOLIO PIECE: MY HEALTHY GARDEN GUIDE

Make a small field guide for your family’s garden or pots. Include drawings of three helper insects and three pests you found, your slug-trap or pest-patrol chart, your spore print or mold-garden drawings, and your garden detective case file. End with a page called “How I Keep My Garden Healthy” listing five habits, such as watering in the morning and looking under leaves.

A neat guide like this can also become an educational poster or journal exhibit at a county fair or a 4-H Cloverbud show-and-tell; check your fair book for youth poster classes.

LOOK FOR	WHAT IT MEANS
Bugs	Drew and named at least three helpers and three pests from real observation.
Pest control without poison	Used hand-picking, traps or barriers and kept a record for at least a week.
Fungi	Can explain one helpful and one harmful fungus and why wild mushrooms are never eaten.
Detective work	Completed a case file, following the steps and checking results over a week.