Fifth Grade Science Overview

	First Semester	Second Semester
Science	*BASIC ENVIRONMENTAL SCIENCE* Scientific inquiry Indicator species Wetlands model Metric conversions Ecosystem diversity Biomes Water cycle Astronomy Renewable and non-renewable sources Energy conservation	*BASIC LIFE AND PHYSICAL SCIENCE* Weather patterns Classification systems Human body structures and systems States of matter Types of energy Principles of physics

Grade 5

Science

Teacher Manual

Oak Meadow

Oak Meadow, Inc.
Post Office Box 615
Putney, Vermont 05346
oakmeadow.com

Table of Contents

Introduction

This teacher manual is intended to help you support your student's learning. In addition to factual answers to assignment questions, you will find suggestions for ways to guide your student's learning and tips on how to assess their responses. Along with the learning assessments found in each lesson of the coursebook (which highlight learning goals for each lesson), these tools will help you evaluate, track, and document your student's progress.

You are encouraged to use a weekly planner and the assignment checklist in each lesson. Help your child learn to use these organizational tools as well. Time management is an essential skill for students to learn, and one that will be useful for their entire lives.

In this teacher manual, you will find the full text for all assignments. The activities and experiments are listed without the text. Teacher manual answers are shown in **orange**. If more information is needed about any assignment, you can refer to the full text and reading material in the student's coursebook.

For obvious reasons, it is best not to share this teacher manual with your student. Each student should be encouraged to come up with their own answers, and sometimes a student might go beyond what is required for the assignment. This is to be encouraged! When a student gets a factual answer wrong, you can share the correct answer. The focus should always be on the learning process rather than on a sense of judgment. Several incorrect answers related to a particular topic point to an area the student will benefit from revisiting.

If you notice a student's answers matching those of the teacher manual word for word, initiate a discussion about plagiarism and the importance of doing original work. Students in fifth grade are just beginning to learn about this concept, and any discussion about it should be approached as a learning opportunity.

We encourage you and your student to explore the topics introduced this year in active, experiential ways. We believe a real understanding and appreciation of the wonder of the world and the joy of learning only comes about when you and your student are fully participating in it.

Lesson

1

Scientific Inquiry

Assignments

1. After reading about bird beaks, collect as many pictures of birds as you can. Arrange your bird pictures according to beak type, and group the different beak types together.

   Paste the pictures on a piece of paper, grouped according to beak types, and then draw pictures of the food that each bird eats, using the information in "Bird Beaks as Tools" as a reference. Alternately, you might like to make up a game that matches each bird with its food.

   This exercise is designed to help students become aware of how the form of a bird's beak relates to its function, namely what a bird eats. Games that students may want to play are card games with bird cards, or a bird board game that has each bird trying to make its way to the food it prefers.

2. Observe the birds in your backyard or a local park. Ask yourself what type of food each bird might eat based on the shape of its beak. Make a list of at least three different types of birds you observe (if you don't know the type of bird, just describe it as well as you can, particularly its beak shape). If you can't observe birds directly, find three different pictures to use. Create a hypothesis for each that predicts which types of food the bird will prefer.

   Students should make a list of birds and a sketch of the birds' beaks, and then form a hypothesis about what type of food they eat. Students are encouraged to use a bird guide as a reference and to check their work.

ASSIGNMENT SUMMARY

- ☐ Read "The Scientific Method" and "Bird Beaks as Tools."
- ☐ Collect pictures of birds and group them according to beak type.
- ☐ Make a guess about the bird's diet based on its beak.
- ☐ Observe birds and make predictions about their diets.
- ☐ Experiment: Bird Beaks

Experiment

Bird Beaks

Design a simple experiment to determine which types of food the birds actually eat. One way to do this is to purchase different types of birdseed and set up "feeding stations." For instance, you might wonder, "Will only birds with triangle-shaped beaks eat sunflower seeds?" Or you might ask, "If I put out two different types of bird seed, one with shells and one without, will the birds that eat from each pile of seed have different types of beaks?" You can pose whatever question you like! Once you decide on your question and make a prediction about what will happen, brainstorm ways to test your hypothesis.

List the steps of the scientific method and follow them one by one as you carry out your experiment. Try to remove as many variables as you can. For instance, in this experiment, a variable might be the location of the bird seed. If one pile of bird seed is raised off the ground (where birds feel safe) and one is on the ground near your dog's resting spot, how might this variable (location) affect your experiment results? You want to make everything the same except for the one thing you are testing.

After conducting your experiment, write a few sentences about what happened during each step of the scientific method. What are your conclusions? How could your experiment be improved?

Students should follow these steps of the scientific method (each step should have at least one or two sentences written about it):

Observation/question: Students write a question that the experiment will try to answer.

Hypothesis: A prediction or hypothesis is made, based on what the student already knows.

Experiment: The procedure for the experiment should be described step by step, taking into account (and controlling) as many variables as possible.

Results: Observations should be recorded as accurately and objectively as possible and organized in a logical way (table, chart, list, etc.).

Conclusion: Students draw conclusions based on the results and reflect on additional ways to expand on or follow up the experiment.

Lesson

2

Scientific Ways of Knowing

Reading

Read "Scientific Ways of Knowing" and "Frogs" (found in Reading Selections).

Assignments

1. After completing the frog experiment in this lesson, make a prediction about the frog population based on what you observed. What did you discover? Are frogs in your pond in trouble? Can you think of any other explanations for what you found? Can you think of ways to help the frogs in your area keep a healthy population?

   Support your findings with evidence. That means you will give specific examples of why you believe what you say, and what led you to have this opinion.

   Note: If your experiment lasts longer than two weeks, just complete this assignment when your experiment ends.

   If there has been a recent change in land use (new housing development or shopping mall) this may mean that frog habitat has been destroyed, leading to fewer frogs. If students check the pH of the pond and find it to be very acidic, they might speculate on why this is so—are there factories in the area, or pulp mills? Where does runoff to the pond come from? Another factor that may influence the frog population is weather. If it is a drought year, there may not be as many frogs or tadpoles. Students are asked to support their findings with evidence, so look for the student to use their knowledge to make an informed speculation. Students will be expected to support their findings with specific evidence throughout this course.

   Students may want to present their results to their local conservation commission, or write letters to their state representatives. These results can be very useful as a basis to measure long-term changes in their area.

ASSIGNMENT SUMMARY

- ☐ Read "Scientific Ways of Knowing" and "Frogs."
- ☐ Make a prediction about the local frog population.
- ☐ Consider how humans affect the environment.
- ☐ Complete a science test.
- ☐ Experiment: Frog Population

2. Write a paragraph about the ways humans have affected the environment, both for good and bad. Do some research on this topic so you can back up your thoughts with facts (support your opinion). Include any ideas you might have for ways that people could change their behavior to help the environment.

   Students are asked to research the specific impact of human activities. What happens to animals and plants when humans are involved? How is the forest affected? Foresters, scientists, businesses, and conservationists all have opinions and can be used for research. Since field research is ongoing, magazines can also be an excellent source. Here are a few aspects students may consider regarding the long-term results of human activity:

   - **Some birds and large carnivores cannot survive without substantial square mileage of wilderness.**
   - **Mining and development create pollutants that poison parts of the ecosystem or slowly damage an animal's ability to reproduce.**
   - **When a specific habitat is disturbed or disappears (such as a type of tree or wetlands), animal populations that depend on these areas decline.**

3. Complete the science test (found after the experiment).

   Test and answers are found after the experiment.

Experiment

Frog Population

Design an experiment to determine if the frog population in your neighborhood is healthy and growing or having any problems. Find a pond in your neighborhood where you can observe frogs. You may want to record data from your pond site for several weeks, so it should be a place you can visit frequently. The spring is the mating and egg-laying season, but frogs may be found throughout the summer and fall. They may be hibernating in your area in the winter.

Choose a topic from the following list to research and use as the basis for your hypothesis.

- **Habitat destruction.** This can include roads that were built where frogs have to cross to reach their breeding ponds. You may need to talk to older adults to learn about how the landscape used to look.
- **Pollution, pesticides, or acid rain.** You may want to talk to farmers or landowners around your pond. You could test the pond water's acidity.
- **Ultraviolet (UV) radiation.** Since this affects mainly the egg production and viability, you might conduct a frog count to see how many are hatching and making it to adulthood.
- **Competition and predators.** After doing a frog survey, can you identify any non-native frogs?

Brainstorm ways to design an experiment that will answer your question. Collect your data (pieces of information), and record your observations.

Report the results of your investigation by listing the five steps of the scientific method (question, hypothesis, experiment, results, and conclusion) and writing a couple sentences about what you did for each step.

For each scientific experiment in this course, students are expected to follow the steps of the scientific process, writing one or more sentences for each step. Look for an experiment design that takes into account variables and tries to control them. Also, look for students to write a conclusion that not only refers to the original intent of the experiment, but also specifies ways in which the experiment might have been improved (or compromised).

Science Test

Complete the following test to show what you have learned. Answer any questions in complete sentences.

1. List the five steps of the scientific method, and explain each one.

   Observation/question: A question (often based on an initial observation) is posed that the experiment will try to answer.

   Hypothesis: A prediction or hypothesis is made about what might happen.

   Experiment: The experiment follows a step-by-step procedure that takes into account (and tries to control) as many variables as possible.

   Results: The results of the experiment are observed and recorded in an organized way.

   Conclusion: Based on the results, a conclusion is drawn about what the experiment showed; usually the conclusion also takes into account flaws in the experimental design.

2. Explain why variables must be taken into account in a controlled experiment.

   A controlled experiment is one that can be repeated exactly with the same results. A single variable, such as temperature or location, can easily alter the results of an experiment, so all variables except the one being studied are controlled as much as possible to achieve the most accurate results.

3. List three different types of bird beaks, and describe how they are related to the bird's diet.

   Birds have different shaped beaks to enable them to eat their favorite foods. Their beaks are like tools for them. Here are some types of beaks that students might describe:

   - **Duck: wide bill with sieve-like edge strains out water while capturing plants and small organisms.**
   - **Toucan: large beak plucks whole fruits off trees.**

- **Pelican: long beak with large lower pouch scoops up fish.**
- **Hummingbirds: long thin beak reaches deep into flowers to gather nectar.**
- **Cardinal: cone-shaped beak cracks open seeds and nuts.**
- **Herons: spear-shaped beak spears fish.**
- **Raptors: curved, hook-shaped beaks for tearing meat.**

4. Describe a frog's life cycle.

   The three phases of a frog's life cycle are adult frog, egg or spawn, and tadpole.

5. What is an indicator species? Why are frogs commonly considered one?

   An indicator species is sensitive to changes in the environment, and can show the first signs of an imbalance in nature. Because they take in both air and water through their skin, frogs are very sensitive to pollution.

6. List four things that can cause problems for frogs, and explain why each is a problem.

   Habitat destruction: Frogs need both dry land and a pond environment for their survival; if one of these habitats is disturbed, the frog life cycle can be interrupted.

   Depletion of the ozone: Changes in temperature due to ozone depletion can interfere with the development of frogs' eggs.

   Pollution, pesticides, and acid rain: Frogs will take into their bodies any pollutants in the air or water, and can easily become sick or die.

   Competition and predators: Non-native species or animals who have been dislocated due to habitat destruction can quickly alter a frog population.

Lesson

6

The Web of Life

Reading

Read "Energy in Ecosystems" (see Reading Selections).

Assignments

1. After completing the reading assignment, make a list of eight different things that you eat. Describe the food chain for each food.

   The student's challenge will be to identify the connections between food (the end product) and the sun, which is at the beginning of each food chain. A food chain shows how energy moves through an ecosystem. This may require some research or assistance from you. If a student has listed cereal and chicken on the list of foods, for instance, the food chains might look like this:

   Cereal: sun → oats → me

   Chicken: sun → seeds → insects → chicken → me

   Technically, every food chain goes from the sun to producers (plants) to consumers to scavengers to decomposers. In this exercise, however, students are asked to focus on the links of the chain before the food gets to their plate.

2. Using the eight food chains you identified above, draw a food web that shows how all these things are connected. Take your time to draw your food web carefully, in color, and label each segment of it. Make it clear how things are related.

   The food web should start with the sun (as all food webs do!), then move to plants, and then animals, finishing with the human. Using the cereal and chicken food chains above, for instance, the food web would show how the two chains are connected. The student's drawing may contain scavengers and decomposers, as these are important elements of any food web.

ASSIGNMENT SUMMARY

- ☐ Read "Energy in Ecosystems."
- ☐ List the food chain for different types of food.
- ☐ Draw a food web.
- ☐ List plants and animals you would raise on a farm.
- ☐ Complete the science test.
- ☐ Write the results of your mold experiment.

3. Make a list of the plants and animals you would raise if you were a farmer. Explain why you chose each of them.

   Make sure your student gives reasons for their choices. Here is a sample response:

   If I were a farmer, I would raise crops that were good to eat and easy to store. Since I live in New England, this means apples, squash, tomatoes, and broccoli. I would have a small, diverse organic farm and sell directly to my customers at a farmers' market. Organic produce is better for the consumer, and better for the environment. I would also raise chickens for collecting and selling eggs, and a few goats for milk and making cheese. In this way, I could meet the needs of my family and know that the foods that we were eating are as healthy as possible.

4. Complete your mold growth experiment. Did you see any mold growth? Did different types of molds grow on different foods? Describe the changes as carefully and accurately as you can. Perhaps you will measure the mold growth in terms of length and width, or you can estimate how much of the item is covered with mold (10 percent, 50 percent, etc.). Try to be as exact as you can. In addition, make drawings of the different kinds of molds that you grew.

   When you are finished with your experiment, be sure to put your sealed bags into the garbage. Don't open them because some kinds of mold are dangerous to breathe. Remember, safety first!

   Conclusions: Did the conditions the bags were kept in (warm + light, warm + dark, cold + dark) have any effect? Why do you think that the food needed to be dipped in water?

   For each step of the scientific process, write one or two sentences about what you did, what you observed, and why you think it happened.

   Mold growth can be measured in inches/centimeters, or it can be recorded with an estimated percentage (e.g., 25 percent of the bread was covered with mold). Drawings should accompany the data, and students should write one or two sentences for each step of the scientific process.

   Results: Students will find that different molds grow on different types of food. They should note color and appearance of mold in their drawings. In general, the "cold and dark" specimen will have the least growth.

   Conclusions: Molds are fungi, and so they are neither plants nor animals. They need moisture and heat to grow. They do not need light, so the students may notice good growth in the warm and dark specimen. The food needed to be dipped in water because molds need moisture for growth. Some mold spores are also waterborne (others are spread in the air, or by insects and animals).

Science Test

1. Describe two different environments.

   The student might mention any number of environments, such as a forest, a desert, the bottom of the ocean, or your backyard.

2. Explain the difference between a food chain and a food web.

   A food chain shows how energy moves through an ecosystem, from the sun, through plants (producers) and animals (consumers, scavengers, and decomposers). When a lot of food chains are linked together, it is called a food web. Like the strands in a spider web, all the linked food chains are interdependent.

3. How does each and every food chain begin?

   Each and every food chain begins with the sun! The sun is the source of the energy for every living thing on Earth.

4. How does each and every food chain end? Why is this such an important step in the food chain?

   Every food chain ends with the decomposers. They take dead things and turn them into soil, which in turn supports the plants in beginning another food chain. This forms the final link in the full circle of the food chain.

5. Define producers, consumers, scavengers, and decomposers. Explain the role of each in the environment.

   Green plants are called producers; they are the only link in the chain that can use the sunlight to create their own food. Animals that get their energy by eating other living things are called consumers; consumers can eat plants and/or animals. Scavengers eat only other animals that have already died, acting as the clean-up crew for the planet, eating dead animals before they spread disease. Decomposers break down any remaining dead matter (plants and animals), releasing rich nutrients back into the soil.

6. Why are plants so important to Earth?

   Green plants (producers) are significant because they use the energy from the sun directly to produce their own food. Only plants can make their own food. In this way, plants capture the energy from the sun and transform it into a food/energy source for every animal on Earth.

7. What happens to energy in each step of the food chain?

   About 90 percent of the energy is lost in each step of the food chain. The energy that is lost in each link of the food chain is given off in the form of heat energy.

8. Why do some people want to keep the human food chain short by eating grains instead of meat?

   Eating lower on the food chain means we benefit from a greater amount of food energy since so much energy is lost in every step of the food chain. Also, many people believe that using land to grow crops to feed people (rather than using those crops to feed animals that people will eat) is a more sensible use of land and may eventually help eliminate world hunger.

9. Explain diversity in an ecosystem and why it is important.

   Diversity in an ecosystem refers to having many different types of plants and animals in one area. This makes an ecosystem stronger because it is less likely to be thrown out of balance and unable to recover if one type of species is altered (increases or decreases).

Lesson

17 Conserving Earth's Resources

Reading

Read "Recycling" and "Food and Hunger."

Assignments

1. Keep a record for one week of everything you eat. Each day, check to see if you had food from each of the food groups (carbohydrates, proteins, vitamins and minerals). If you did not, eat a more balanced assortment of foods the next day. At the end of the week, assess your diet. Do you think you have a healthy diet? Why or why not? What areas do you think you could change? Would these changes have a positive effect on the environment? How?

   Your student is keeping a detailed record of what they eat. This is harder than it sounds—it may help if your student keeps a notebook or chart in the kitchen. You can also help your child remember what was eaten at the end of each day and check to make sure the list is being kept up to date.

   Most adults have some opinions about diet, especially their own and their children's. In this exercise, it's recommended that parents allow students to explore their own feelings about food, free from parental influence.

   The student is asked if they think their diet is healthy and why, and what areas of their diet might be changed. Students are also asked to make the connection between diet and the environment. This may lead to interesting questions and conversations.

2. Choose one of the following projects to complete.

   a. Do service stations recycle motor oil in your community? Visit or call three service stations to find out. Where do they take it, and what is done with it there? Report your findings.

ASSIGNMENT SUMMARY

- ☐ Read "Recycling" and "Food and Hunger."
- ☐ Keep track of what you eat, and assess your diet.
- ☐ Complete an assignment related to the reading.
- ☐ List recycled and plastic materials in the home.
- ☐ Reflect on how to take care of Earth.

Motor oil is harmful to the environment because many of its hydrocarbon components are poisonous and do not easily break down. Your student may be surprised to find out how carefully the disposal of motor oil is regulated.

b. Learn about the use of hemp as an alternative to cutting down trees for paper.

Until the mid-nineteenth century, paper was made from cotton, straw, hemp, and other fibers, not trees. Both hemp and kenaf are bushes that are easier to cultivate than trees because they are disease-resistant, are nitrogen fixers, and work well in crop rotation. Both grow much more quickly than most softwood trees that are often grown for paper pulp, maturing from seed in five to six months. That means that crops of hemp or kenaf can be grown and harvested several times before a stand of coniferous trees has grown sufficiently for harvest and making pulp.

Producing paper from hemp is better for the future health of all of us because the toxic chemicals needed to make quality paper from wood, the worst of which is dioxin, are not used in hemp production. Hemp cultivation does not deplete the soil of minerals the way harvesting trees does.

c. Compare a piece of recycled paper and a regular piece of paper and compare the two. Do you see any difference? If so, what is it?

The difference between recycled and new paper is often insignificant unless you're dealing with heavyweight paper.

3. Make a list of items in your home that are made of recycled material. Make a list of items that are made of plastic, and write down ideas for alternate materials that could be used for these items.

This assignment may be challenging as sometimes it is hard to tell if something is made of recycled material. The process of looking closely at the materials in your home and trying to determine their origin will be a worthwhile experience.

4. You have learned many ways to be a good caretaker of Earth so that our planet remains a healthy, safe place in which to live. Reflect on what you have learned and which things feel most important to you. Write your thoughts in a paragraph, or express them in an artistic form (a drawing or painting, a poster, a poem, etc.)

This exercise is another opportunity for your student to appreciate their contribution to caring for the home and the planet.

Lesson

23 Body Tissues

Reading

Read "Body Tissues" (found in Reading Selections).

Assignments

1. Do some research to learn what a neuron looks like. Draw a picture of a neuron, and label all the organelles within.

   Students will need to do research in the library or online to complete this assignment. The neuron drawing should include the following organelles: endoplasmic reticulum, mitochondria, Golgi apparatus, and nucleus. It may also include the neuronal membrane, dendrites, and axons. The drawing should be clearly labeled and neatly drawn.

2. Choose one of the following fingerprint projects.

   These experiments are fun and easy to do. Students should be able to categorize their fingerprints according to the three categories (arches, whorls, and loops). It may be interesting to take the fingerprints of others as well and compare them.

   a. Lift your prints! Using a pencil, rub a *very* black square on a white piece of paper. Make sure the square is shiny black. Rub your thumb, print-side down, onto the square. Take a piece of tape, and put the sticky side onto the black part of your thumb. Press the tape down. Now remove the tape from your thumb, and tape it onto a piece of white paper. Wash your hands. Use a magnifying glass to study your fingerprint. Describe your fingerprint. Does it have arches, loops, and/or whorls?

   b. Another fun way to look at your fingerprints is to *blow them up*! Press your thumb onto an ink pad, and then press it onto an uninflated balloon. Now, blow up the balloon, and see your fingerprint magnified. Write a description of your fingerprint.

ASSIGNMENT SUMMARY

- ☐ Read "Body Tissues."
- ☐ Draw and label a neuron.
- ☐ Choose a fingerprint project.
- ☐ Make a list of family blood types.
- ☐ Describe the purpose of five different organs.
- ☐ Activity: Muscle Model

c. Take the fingerprints of your friends and family members. See if you can put them into their respective categories: arches, whorls, or loops. Which category do most of your fingerprints fall into? Which category do the fewest fall into?

3. Make a list of all of the blood types in your family. Try to find out your own blood type, if you can. See who could donate blood to you if you needed it.

   Some family members may not know their blood types, but it will be educational for the student to learn what they can.

4. Make a list of five organs in your body. Describe the job of each one.

   Answers will vary and may include eyes, tongue, lungs, heart, kidney, liver, and stomach.

Activity

Muscle Model

Students should compare the muscles in their arms to the model, flexing and extending their own muscles as they move the balloon model.