Sixth Grade Science Overview

	First Semester	Second Semester
Science	Scientific method Experimentation Cell structure Cell division Plant structure and reproduction Photosynthesis Soil and nutrients Classification of living things Plant and animal kingdoms	Animal life cycles Food chains and food webs Ecology Ecosystems Global climate change Human nutrition Human body structures and systems

Grade 6

Basic Life Science Coursebook

Oak Meadow

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Introduction

Welcome to the Oak Meadow Basic Life Science course. Life science is the study of all living organisms and the exploration of how life is connected and interdependent. The balance of nature is an exciting concept, sometimes mysterious, sometimes complicated, but always interesting and often surprising. Scientists are constantly learning more about every aspect of life science, and this course is a thorough introduction to the fascinating journey to understand the nature of life on Earth. The sequence of topics and skills in this course are presented in a way that encourages exploration and wonder in the natural world, while building a strong foundation in the scientific skills of observation, reflection, and concise writing.

Course Materials

This coursebook is your primary resource for completing the course. The material in this coursebook is divided into 36 lessons, and each lesson is designed to take about a week to complete. Within each lesson, you will find four main components: lesson objectives, readings, assignments, and tests. There is an assignment checklist at the beginning of each lesson so you can check off each assignment as it is completed. There is also a learning assessment form at the end of each lesson for your parent or tutor to track your progress over the year. As you become familiar with the format of this book, you will find these components very useful when organizing your lessons and your time.

Within each lesson, you will find four main components: lesson objectives, readings, assignments, and tests.

This course asks you to conduct research, so you will need access to a library with a good collection of science books written for the middle-school student. If you choose to use the internet, make sure you find websites appropriate for middle-school students.

Some of the projects develop writing skills, others engage your artistic expression, and some assignments encourage you to explore various aspects of your community.

A main feature of this Oak Meadow course is the many creative projects you will have the opportunity to complete. In each lesson, you will find a "Choice Assignment" that contains several different projects for you to choose from. Some of the projects develop writing skills, others engage your artistic expression, and some assignments encourage you to explore various aspects of your community. Our activities and assignments have been thoughtfully designed to appeal to a variety of different learning styles, and we encourage you to select the ones that appeal to you. As the year progresses, consider challenging yourself with the full range of choices, and reflect upon your strengths as a learner. Understanding your learning style will help you throughout your education and trying new things is a great way to expand your learning!

These projects call for special supplies, and while many of these items are common household items, a few others will require a special purchase. A full materials list for the course can be found in the appendix, and you will also find a materials list on the first page of each lesson.

Course Requirements

Each week you will be asked to complete a variety of assignments, including discussion points, experiments, research papers, observations, drawings, and tests. Science requires a different approach from your other subjects, so please read the information below for guidance about how to complete the various assignments in this course.

Writing for a Science Course

When completing writing for this course, it is important that you take the time to explain your observations and ideas. Here are some suggestions to help make your writing clear and informative:

Science writing requires a certain amount of precision and using the scientific terms will make your writing more exact.

1. Answer all questions in complete sentences and refer to the question itself in your response. Your reader should know the question you were asked from reading your answer.

   Example #1

   What are the two main types of root systems?

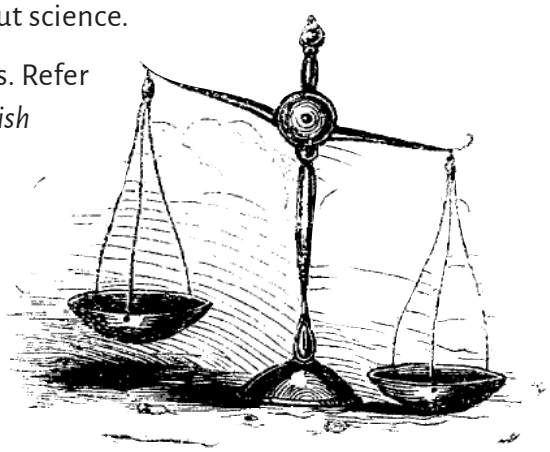
   The two main types of root systems are fibrous root systems and taproot systems.

   Example #2

   Name two common members of the phylum Mollusca.

   Two common members of the phylum Mollusca are clams and squid.

2. Use scientific terms when answering questions or writing reports. These words are in italics in the lesson text and defined in the margins near where they first appear. Science writing requires a certain amount of precision and using the scientific terms will make your writing more exact.
3. Make sure you use examples from the reading or from your observations to back up your statements.
4. Assume the role of expert, and write out your ideas as though you are explaining them to someone who is just learning about science.
5. Please proofread your work for clarity and small errors. Refer to the English manual in the *Oak Meadow Grade 6 English Coursebook* for more information about how to edit and proofread your writing.
6. If a writing assignment asks for one or more pages of writing, you can assume that one page equals two or three paragraphs of three to eight sentences each. Use your best judgment—two three-sentence paragraphs are not going to equal one page.



Critical Thinking and Discussion Points

Throughout the course, you will encounter sections called "Your Thoughts." These provide the opportunity to pause and explore a topic in more depth or to review a concept you have just learned. You can do this by discussing your thoughts with a sibling, friend, parent, or other adult. The objective is to engage with the material before you move on to the next topic. (If you are enrolled in Oak Meadow School, you are not required to submit this work to your Oak Meadow teacher, but you are expected to engage in these exercises. Check with your teacher if you are unclear.)

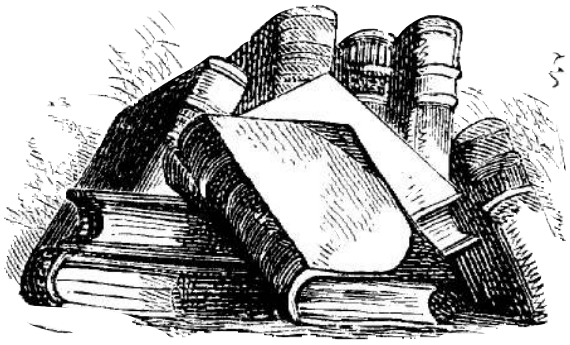
Experiments and the Scientific Method

The experiments in this course are designed to follow the scientific method, which is covered in detail in lesson 1. There are five steps to the scientific method:

1. Question
2. Hypothesis
3. Procedure
4. Observations
5. Conclusion

Unless stated otherwise in an assignment, you are expected to include these five steps in your write-up of any experiment you conduct. Please organize your write-ups so that each step is clearly labeled.

Research Papers



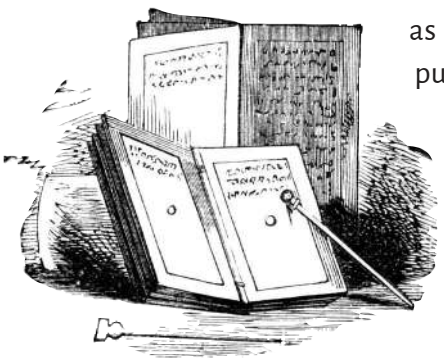
The key to a good research paper is finding clear and reliable information on your topic. When embarking on a research paper, please take the time in the beginning to locate resources that are easy to understand. Books written for middle-school students are a great place to start. If you are using the internet, consider using sites that are designed for young people. You will have a much easier time writing your paper if the information you are using is easy to understand.

Keep track of the resources you use for conducting research and include a list of your sources at the end of the report. Remember to write your paper in your own words, and do not copy directly from websites or books. Copying someone else's words or ideas is called *plagiarism*, and it violates an important academic principle about the ownership of ideas. In some ways, plagiarism is like stealing. Understanding plagiarism will become more important as you get older. For now, the best way to avoid it is to make sure that everything you write is in your own words and to provide a list of resources at the end of your paper to show what books and websites you used. See the appendix for more information on citing your sources and on how to avoid plagiarism.

Copying someone else's words or ideas is called *plagiarism*, and it violates an important academic principle about the ownership of ideas.

Observation Skills

This science course will help you develop your skills of observation, which are key skills for all scientists. When making observations, whether for an experiment, or for another type of activity, it is important to develop good note-taking habits. Your notes should be as detailed as possible, describing what you observed with your senses. Consider purchasing a notebook with tear-out pages that will become your observation notebook. When taking notes, make sure that your handwriting is legible. You will need to refer to your observation notes when writing up your experiment. Before you begin your observations, determine whether you can organize the page in such a way to make note-taking easier. Use of a chart or a diagram can help you keep your observations organized.



Accurate Drawings

Learning to draw accurately is another important scientific skill. When you are asked to make a drawing or a diagram, please take the time to really study the object and slowly find the form on your paper. Don't worry about perfection in your drawings, as it is the act of studying, or seeing the object, which is so important in science. All drawings, posters, and diagrams should be completed on unlined white paper (except for quick sketches made during observations). Please do not trace your drawings directly from another source; all drawings should be completed freehand and from an object before you. Always use colors to add realism and an artistic dimension to your work. Make sure to label all diagrams and drawings.

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Lesson Tests

At the end of each lesson you will take a short test. These tests are "open book," which means that you are encouraged to go back through the lessons and to review the material before you answer the questions. This allows you to revisit important topics and to engage with the material before moving on to the next lesson. However, when it comes time to write out the answers, you must provide answers in your own words (otherwise you would be plagiarizing!). You might find it easier to close the coursebook so that you are not tempted to copy answers straight from the book. The ability to write about an idea in your own words is a simple way to assess your understanding of that idea. If you cannot come up with a way to compose an answer on your own, then you most likely need to review the material further.

Tests are "open book," which means that you are encouraged to go back through the lessons and to review the material before you answer the questions.

Unit Reviews

At the end of each of the four units in this course, you will complete a unit review. The purpose of the unit review is to give you an opportunity to go back through material you have just covered. The ideas in this course build upon each other and when you reach the end of the unit, your perspective on the material will be different from when you encountered it the first time. We encourage you to look for connections between the various topics as you review the material.

Each unit review has two parts. For the first part, you will read through the test questions from the unit. Review any topics that

The ideas in this course build upon each other, and when you reach the end of the unit, your perspective on the material will be different from when you encountered it the first time.

are still confusing or that you don't remember well. For the second part, you will complete a review activity of your choice from a list of three options. Try each one of the choices by the end of the course.

For Students Enrolled in Oak Meadow School

As an enrolled student, you will benefit from regular feedback and support from your Oak Meadow teacher. Your Oak Meadow teacher is also available to help with questions you may have about assignments or about your progress. Communication is essential to developing a great relationship with your teacher during the school year.

If your child is enrolled in Oak Meadow School, you'll find a reminder at the end of each lesson that instructs you on how to document your student's progress and when to submit your work to your Oak Meadow teacher. Continue working on your next lessons while you are waiting for your teacher to send feedback on your child's work. After you have submitted the first 18 lessons, you will receive a first-semester evaluation and grade. At the end of 36 lessons, you will receive a final evaluation and grade.

Submitting Work to Your Oak Meadow Teacher

You are welcome to submit your student's work using email, Google docs, or postal mail. You will find detailed instructions on how to submit your work in the *Oak Meadow Parent Handbook*.

Here are a few tips:

- Please make sure to carefully label each submission. Teachers receive many submissions each week, and we want to make sure your child's work is accounted for.
- If you send work through the postal mail, be sure to include a self-addressed, stamped envelope so your teacher can return the work to you. Receiving the return package from your teacher is an exciting part of the distance learning relationship for many children, and we want to make sure the materials make it back to you in a timely manner. Because regular postal mail is not tracked, it's important to keep copies of everything you send.
- If you choose to send work digitally, Microsoft Word documents, a shared Google doc, and Adobe Acrobat PDFs are the easiest formats for our teachers to work with. When in doubt, please check in with your teacher to determine the best format for submitting work.

- Some of the assignments will instruct you to send to your teacher an audio or video recording of your student performing, reciting, or giving an oral presentation. You can make digital recordings using a camera, computer, or cell phone and send your recordings to your teacher in MP3 format. If you do not have the equipment to make a digital recording, discuss other options with your Oak Meadow teacher.
- It is a good idea to keep track of when lessons are submitted and when they are returned. With so many important pieces of work going back and forth in the mail, mistakes do occur, and a good record-keeping system helps clear things up. You can use a weekly planner for this purpose.

When both the family and the teacher keep to a regular schedule for submitting and returning lessons, everyone benefits, especially the student. Timely feedback, encouragement, and guidance from a teacher are key elements for all learners, and this is especially important in distance learning.

For all students using this curriculum in any form, we hope that you enjoy this course and that you gain a new appreciation for the life inside you and all around you. May your exploration of the world of life science be successful, exciting, and productive!

Lesson

1

Science and the Scientific Method

What Is Science?

Science describes what we know about our world. We learn about the world by observing what is happening all around us. We observe through our senses: we watch, we listen, we feel. Then we reach conclusions about what it all means: we make sense out of the world.

Scientists and teachers tell us what they have learned, and what they think is important for us to know. Yet, in a way, we are all scientists. We ask questions; we guess what the answers will be; we watch to see what happens; our minds record the results and decide what the results mean; and then we take this knowledge and use it throughout our lives as we decide what to do, how to do it, and, in general, how to lead our lives. This is an example of what is called the ***scientific method***.

The scientific method is the form that scientists use to examine the world. Scientists do experiments to find out why things happen the way they do. There is not much difference between the way we make sense of the world and the way scientists do. In both instances, there are many things that affect what our conclusions will be. How you feel, for instance, may depend on how much sleep you got last night. If you are busy watching TV, you are less likely to notice that someone left the refrigerator door open in the kitchen. If you are in a hurry, you are less likely to notice that you didn't clean up a

All experiments in this course should be written up using the scientific method format. Please refer to this lesson for guidance when completing assignments in future lessons.

ASSIGNMENT SUMMARY

- ☐ Analyze the caffeine experiment.
- ☐ Test your power of observation.
- ☐ Choice assignment
- ☐ Complete lesson 1 test.

MATERIALS

- ☐ pencil
- ☐ paper
- ☐ two sets of 13–20 items collected from nature
- ☐ **Choice Assignment**

  Animal Observation
  pet

Scientific method: the procedure scientists use when conducting an experiment; it specifically refers to the five steps of asking a question, forming a hypothesis, carrying out a procedure, recording observations, and drawing conclusions.

mess before rushing out the door. There are an endless number of situations or factors that may influence what you notice or what you decide to do.

A scientist, however, is usually trying to determine the effect of a particular factor on something or a specific effect or situation. Therefore, a scientist will try to set up a ***controlled experiment*** to test the effect of a particular thing on something else. A controlled experiment attempts to test only one factor, or ***variable***, at a time. A variable can change throughout the experiment, while everything else must remain the same. A scientific experiment will always have the following steps:

1. First, a question is asked for which you do not know the answer. Usually this question comes out of an observation that has been made. The question should be brief, clear, and representative of something that you can test for. Here are some sample questions that might lead to an experiment: Why does steam rise? Can dogs understand human language? What are the effects of caffeine on sleep?
2. A statement is made that tells what the answer to this question might be. This statement is called a ***hypothesis***. It is a statement that the experiment attempts to prove or disprove. Here are some sample hypotheses that you could try to prove in a scientific experiment: Steam rises because water vapor is lighter than air. Dogs do not understand human language. Caffeine intake after 3:00 p.m. disrupts normal sleep patterns.
3. A controlled experiment is set up, and the experiment is performed. This is called the ***procedure***.
4. ***Observations*** (sometimes called results) are made during the experiment and recorded. These results tell what we see (or hear, taste, feel, smell) during the experiment.
5. The results are interpreted: the hypothesis is either proved or disproved, and an explanation is given for why the experiment happened the way it did. This is the ***conclusion***, and it tells what we learned during the experiment. Often a conclusion leads to more questions and more experiments.

Controlled experiment: an experiment designed to test only one variable at a time while making sure that all other elements will not change or influence the result.

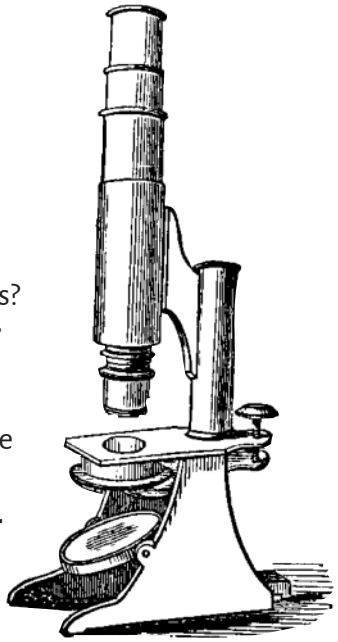
Variable: a factor that can show measurable change over the course of an experiment.

Hypothesis: a statement about what is expected to happen.

Procedure: the way an experiment is set up and carried out.

Observations: information perceived through any of the senses (sight, hearing, smell, taste, or touch).

Conclusion: what has been discovered or learned as a result of the experiment.



The experiment is evaluated by asking:

- Did it really do what it was intended to do?
- Could the method be improved so that it would have better results?
- Does the experiment suggest other experiments that might be undertaken?
- How can the information or process apply to personal life or experiences? This would answer the questions: "What does it all mean?" or "So what?"

Here is a very simplified version of an experiment that might be used to test the effects of caffeine on sleep patterns. A typical experiment would be more controlled than this one, but this should give you the basic idea. Notice how the experiment is written using each of the five steps. **When writing up your experiments in this course, please use this format.**

SAMPLE EXPERIMENT: The Effects of Caffeine on Sleep Patterns

1. **Question:** What are the effects of caffeine on sleep?
2. **Hypothesis:** Caffeine intake after 3:00 p.m. disrupts normal sleep patterns.
3. **Procedure:**
   a. Select a group of people who report that they sleep "normally."
   b. Observe each individual during a normal night's sleep. Record how many times they wake, roll over, mumble, etc. Make sure they have not had any caffeine that day.
   c. Divide the group into four equal groups and give the first group a cup of coffee at 2:00 p.m.; give the second group a cup of coffee at 3:00 p.m.; give the third group a cup of coffee at 4:00 p.m.; and for the fourth group, give no coffee at all (make sure there is no sugar in the coffee because we are testing for the effects of caffeine on sleep, and sugar might also effect sleep patterns).
   d. Observe each individual during that night's sleep. Record how many times they wake, roll over, mumble, etc.
   e. Compare observation notes from the first night to the observation notes from the second night.
   f. Draw conclusions.
4. **Observations:**
   a. The group that didn't get any coffee slept as well the second night as they did the first night.
   b. The group that drank coffee at 2:00 p.m. slept worse the second night.
   c. The group that drank coffee at 3:00 p.m. slept worse the second night.

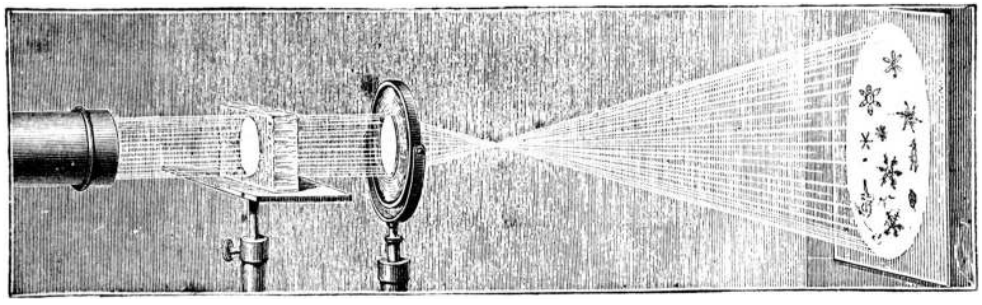
d. The group that drank coffee at 4:00 p.m. slept worse the second night.

5. **Conclusion:** After reviewing the observations and all of the data, it seems that caffeine consumed after 2:00 p.m. disrupts normal sleep patterns. This provides a partial answer to the original question about the effects of caffeine on sleep, but it does not prove the hypothesis that caffeine consumed only after 3:00 p.m. disrupts sleep patterns. In order to learn more about the effects of caffeine on sleep, additional experiments are necessary. Possible experiments could include testing whether there is a time of day when caffeine can be consumed without disturbing sleep patterns. Or this same experiment could be repeated with different levels of caffeine. Each experiment will provide more information about the original question: What are the effects of caffeine on sleep?

You will notice in reading through this experiment that it tests only one small part of the original question about the effects of caffeine on sleep. The scientific method is most successful when there is only one variable in an experiment. If a scientist sets out to test the effects of caffeine on sleep by giving different amounts of caffeine to people at different times of the day, it would be impossible to analyze the results and come to a meaningful conclusion. Scientists have learned that it is most effective to test one variable at a time and to complete many smaller experiments so that their results and conclusions are as accurate as possible.

Your Thoughts

What is the variable in this caffeine experiment? Remember, the variable is the part of the experiment that changes while everything else stays the same, or is controlled. Discuss your ideas with a parent or friend.



Science is so important because it is a part of all of us. We are all science in action. And we are all scientists. The way we decide what we do and how we do things is similar to the way scientists conduct their experiments. The scientific method is really no more than a way of giving more formal structure to a process that goes on inside of us and all around us many times every day. The main difference between

a controlled experiment and the way that most people think and draw conclusions is that in a controlled experiment you take precautions to see that all other factors in the experiment remain the same.

Assignments

1. Analyze the caffeine experiment. Use the four questions below to assess the caffeine experiment described in the last section. Think carefully about aspects of the experiment that could be more controlled or where errors might arise. Write a few sentences in response to each question.
   a. Did the experiment really do what it was intended to do?
   b. Could the method be improved so that it would have better results? How?
   c. Does the experiment suggest other experiments that might be undertaken? What are they?
   d. How can the information or process apply to personal life or experiences? This would answer the questions: "What does it all mean?" or "So what?"
2. Test your power of observation. Go outside and collect 13 to 20 rocks, sticks, leaves, or other items that can be easily collected. Don't look at them too carefully. Place them in a box or basket and cover the opening. When you have paper and a pencil at your side and are ready to make your observations, take off the covering and reveal the objects. Give yourself one minute to carefully observe as much as you can about the objects and their placement using only your sight, but don't write down anything yet. When the minute is up, cover the items again and give yourself three minutes to write as much as you can remember about what you observed. How many objects did you remember? Could you remember very many details about them? Did some objects remain in your memory more vividly than others?

   Now try this again with the same or a different set of items. Give yourself only a minute again, but this time touch the items in addition to looking at them. At the end of the minute, write or draw (or both) what you remember. How did your observation change? How did your sense of touch increase or decrease what you could remember? For an extra challenge, have someone else collect items for you so that until they are revealed, you don't know what the objects are. Challenge someone else with the objects you gathered and see how their observations differ from yours. Some people are great at remembering lots of detail about a few things, while other people are quick to learn just one thing about many objects.

Choice Assignment

Choose **one** of the following projects.

A. **To Be a Scientist.** If you could be any kind of scientist, what kind would you be? Why? To be the scientist of your dreams, you can imagine you are any age, have any amount of money, and travel anywhere you need to. Aim to write about a page of three to five paragraphs to answer these questions.

B. **Scientific Experiment.** If you were going to conduct any scientific experiment, what would it be? What would your hypothesis be? If you can do the experiment, do it. If not, imagine the outcome and write what you think it would be. Use the five components of the scientific method to describe your experiment and its outcomes: Question, Hypothesis, Procedure, Observations, and Conclusion.

C. **Survey Experiment.** Some scientific experiments are surveys, which means the scientists get their answers through interviewing people. Create or design a survey about something you want to know. The survey can be one question or many. Carry out your survey with at least ten people you know. You might want the survey to be confidential and tell the people to put it in your mailbox without their name on it. Sometimes having confidential surveys lets people feel they can be more honest and not be judged for their answers. Use the five components of the scientific method to describe your survey and its outcomes: Question, Hypothesis, Procedure, Observations, and Conclusion.

D. **Animal Observation.** If you have an animal at home, spend some time observing it. When does it like to sleep? To play? Pose a hypothesis about its behavior. Observe it and see if you made correct assumptions. Example: "My dog likes to eat when my family eats," or "My cat only plays with yarn when someone is moving it." Do not try experiments that could hurt the animal or make it uncomfortable. Use the five components of the scientific method to describe your informal experiment and its outcomes: Question, Hypothesis, Procedure, Observations, and Conclusion.

Test Questions

1. What is controlled in a controlled experiment? Provide an example.

2. Come up with three questions that could lead to a scientific experiment.

3. Come up with a hypothesis to test each of the three questions you posed in the last question.

4. What are the five steps of the scientific method? Briefly explain each step.

5. Explain the difference between results and conclusion in a scientific experiment.

FOR ENROLLED STUDENTS

You will be sending a sample of work from this lesson to your Oak Meadow teacher at the end of lesson 2. In the meantime, feel free to contact your teacher if you have any questions about the assignments or the learning process. You can use your assignment summary checklist and the learning assessment form to keep track of your student's progress. In addition, use a weekly student planner to help your student develop time management skills and begin taking responsibility for getting their work done each week.

Learning Assessment

These assessment rubrics are intended to help track student progress throughout the year. Please remember that these skills continue to develop over time. Parents and teachers can use this space to make notes about the learning the student demonstrates or any skills that might need work.

SKILLS	Developing	Consistent	Competent	Notes
Displays focused observation skills				
Demonstrates knowledge of the scientific method				
Shows understanding of controlled experiments and variables				
Forms a hypothesis based on previous knowledge				
Explains the steps of the scientific method				
Reflects on experiment process and ways to gain more accurate results				

Lesson

2

The Environment

Wherever we are, wherever we go, things are going on all around us. It may be hot or cold, it may be noisy or quiet, the sun may be shining brightly, or it may be the dark of night. Many of these things we notice. But there are many, many things that happen that we don't notice at all.

ASSIGNMENT SUMMARY

- ☐ Record your observation-specific environments.
- ☐ Choice Assignment
- ☐ Complete lesson 2 test.

MATERIALS

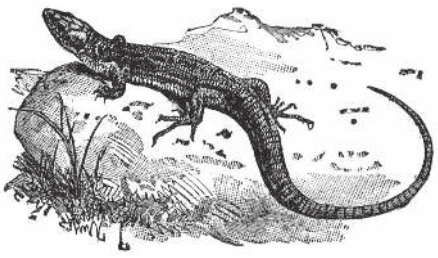
- ☐ pencil
- ☐ paper or notebook
- ☐ **Choice Assignment**

  Blindfold Project
  blindfold

Environment: the surroundings and all the living and nonliving things contained within.

Everything that is around us is called our ***environment***. It includes everything: from the air we breathe to all the plants and animals living around us. Our environment is where we live and everything that is here with us. *Environ* means "to surround," and that is exactly what our environment does; it surrounds us, and we are part of it and dependent upon it for survival.

All living things react to their environment. For example, when temperature, light, the amount of moisture, or other conditions change, organisms will react in certain ways. When a lizard lies in the sun, it warms up and becomes more active. Flower petals close at night. The leaves of many plants change color in the fall. When the sun feels too hot, you might find a shady tree to shelter under.



The environment is the world that all living things share. It consists of all things that act and are acted upon. Yet creatures are not able to perceive everything and all that happens. The

ants living in the ground know nothing of the blooms at the tops of trees that are only a short distance away. In their entire lives they may never travel to the top of a tree, so they may never contact the birds that nest there. But they, like the temperature of the air, and the rain when it falls, are all part of the environment. You can't possibly feel or know all the parts of your environment. But there's no doubt that the more you are aware and the more information you have, the better the chances are for your continued survival in your world.

Observation and Change

How do we know what is going on around us? What is it that happens when we observe? What is it that we are noticing?

Your Thoughts

What are some parts of your environment that you know are there but that you can't see? Discuss your ideas with someone and listen to their ideas.

What we notice are changes. Living things grow and die; move; change size, shape, and place; and do many other things. We usually notice things because there has been some change that one or more of our senses have perceived.

Everything changes. Some things change quickly and we notice them easily; some things change so slowly that we don't notice them at all. Still, change is an important quality by which we identify and describe living and nonliving things.

Assignments

1. For this exercise you will be observing three different environments. Pick two places that are natural areas where you can be relatively close to nature. The third place can be anywhere—it's your choice.

   Sit quietly in each of these places for at least 15 minutes. You are to relax and observe your environment. Pay attention to what you see, hear, smell, and feel. When you are finished, record your observations about each place and what types of things you noticed happening around you. Be specific and describe as many details as you can. Be sure to include any thoughts or feelings that you had while you were observing your environments. You will use these observations for an assignment in lesson 3, so keep them in a safe place.

   a. Visit one of the natural places early in the morning before the world is busy.

   b. Visit the other natural place at dusk, close to the time when the sun sets.

   c. Visit the third place at any time you choose.

Choice Assignment

Choose **one** of the following projects.

These activities will give you practice in making observations.

A. **Weather Journal.** Keep a weather journal for five days. In each entry, describe the cloud patterns, the times the sun and moon rose and set, the temperature, the wind patterns, and any other observations. When the five days are over, answer the following questions:

   - Was there one day that was your favorite in terms of the weather? Which day was it? What was the weather like?
   - If you had the power to make the weather patterns any way you wanted for a week, what would the days be like? Write up your dream weather report for a week's time.

B. **Evening Observations.** How often do you observe the outside environment at night? One evening, at least an hour after the sun has set, go outside without any source of light (no flashlight or candle). If you can, stay out for 20 minutes. Take notice of the changes in your eyesight as it adjusts to the dark. Do you hear different noises at night than you do during the day? Count the number of night sounds you hear or night sights you see. Any surprises? Anything new? Write down your observations when you come back inside. (If you live in a place where there are lots of lights at night, try to find a special time to visit a very dark place at night.)

C. **Blindfold Project.** Go outside with someone you really trust who is willing to be blindfolded. Taking turns, one of you will be blindfolded and the other will act as the seeing-eye guide. The partner who can see should remain beside the blindfolded one, and the two of you should take five minutes to take in what is around you. You can then switch roles. Using your senses of hearing, feeling, tasting, and smelling, what do you observe differently when you can't see? What changes in the environment do you think you would be more aware of during the change of seasons if you were truly blind? What things are you able to notice as a seeing individual? Write two paragraphs describing your observations—one for when you were blindfolded, and one for when you could see. Write a third paragraph explaining the differences between the two ways of observing.

Test Questions

1. Write a definition of *environment* in your own words.

2. In what ways do YOU react to changes in your environment? List and describe at least three ways. (Example: How do changes in the weather affect you?)

3. Do all living things change? List changes that you have observed in three living things in your environment recently. (Example: If the season is changing, have you noticed animals around you losing or gaining their winter fur?)

4. Do nonliving things change? List changes that you have observed in three nonliving things in your environment recently. (Example: How has the sky changed today?)

FOR ENROLLED STUDENTS

At the end of this lesson, you will be sending the first batch of work to your Oak Meadow teacher along with your assignment summary checklist, learning assessment form, or any alternate form of documentation. Include any additional notes about the lesson work or anything you'd like your teacher to know. Feel free to include questions with your documentation—your teacher is eager to help.

If you have any questions about what to send or how to send it, please refer to your parent handbook and your teacher's welcome letter. Your teacher will respond to your submission of student work with detailed comments and individualized guidance. In the meantime, proceed to lesson 3 and continue your work.

Learning Assessment

These assessment rubrics are intended to help track student progress throughout the year. Please remember that these skills continue to develop over time. Parents and teachers can use this space to make notes about the learning the student demonstrates or any skills that might need work.

SKILLS	Developing	Consistent	Competent	Notes
Displays focused observation skills				
Records observations in detail				
Shows awareness of change in the natural world				

Lesson

6

The Seedling

Now that your seedlings have been growing for a week or more, you can examine them more closely. Remember that green plants are different from animals because they do not eat other plants or animals to get their food. Green plants make their own food. In order to make their food, plants need water, light, nutrients, and a medium in which to grow.

Roots

The embryonic root starts the growth of most seeds. Most seeds store more food than the seedling needs for its first days of growth, but they can store very little water. It is important, therefore, that the root, whose job it is to absorb water and dissolved minerals, is the first part that emerges from the seed before the other parts can begin to grow.

Fibrous root system

Tap root system

As a plant grows, it needs more and more water and nutrients. The roots grow longer and new roots continue to grow. There are two main types of root systems: ***fibrous root systems*** and ***taproot systems***.

Fibrous root systems: roots that are made up of many thin branches, which are all similar in size and spread out underground.

Taproot systems: one large, main root that grows straight down beneath the main plant stem.

ASSIGNMENT SUMMARY

- ☐ Observe and describe plant roots.
- ☐ Draw and label a picture of the parts of different plants.
- ☐ Explain the functions of the parts of a green plant.
- ☐ Choice assignment
- ☐ Complete lesson 6 test.

MATERIALS

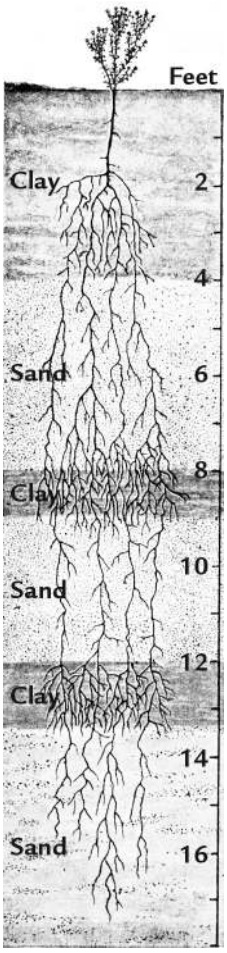
- ☐ magnifying glass or microscope
- ☐ head of cabbage or brussels sprout
- ☐ bunch of celery
- ☐ bulb of garlic
- ☐ knife
- ☐ **Choice Assignment**

Inspect Roots
trowel or small shovel

Research Carnivorous Plants!
research materials about carnivorous plants

Witness Plant Power
several bean seeds
plaster of Paris
paper cup

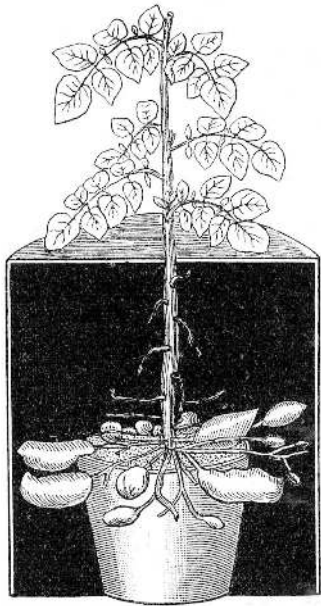
Root hairs: tiny hair-like fibers that allow a root system to absorb nutrients and water.



Fibrous root systems are made up of many thin, branched roots, which are all similar in size. In plants with a taproot system, one main root is larger than the others. Smaller secondary roots grow out from the taproot in all directions, seeking water and nutrients. In both types of root systems, the roots are covered with tiny hairs called ***root hairs***. It is through these root hairs that most of the absorption of water and minerals takes place. The water and nutrients travel from the root hairs, through the secondary roots, up through the taproot and up into the stem.

That handful of rich, lively soil in the cup where you planted a tomato or radish seed is all tied together by hundreds of miles of tiny root hairs, many too tiny to see. The root hairs are constantly absorbing nutrients while holding everything together in the soil.

Roots have two other important functions. They hold the plant in the ground and they keep the plant from falling over. Roots are the foundation that keep the plant in its place and secure it from the forces of wind and rain that would otherwise topple the plant. Since plants are not mobile organisms, they can't just pack up and move from one place to another. But some plants, like crabgrass and mint, will continue to send out shoots from roots as they grow along or beneath the soil. What may begin as a single seed or seedling may eventually grow into a large, intertwined patch or grove of plants, all connected by a complex web of roots. Aspen trees grow in large groves from one underground root system. What appears to be many plants are actually all one interconnected plant.

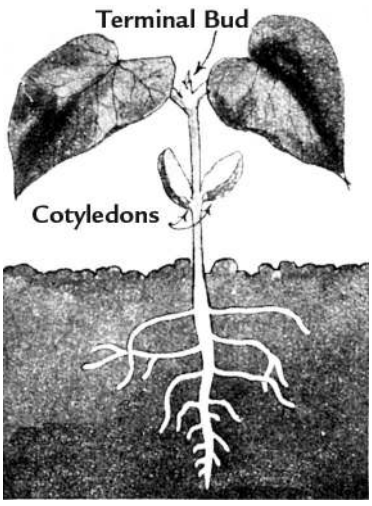


Potato plant

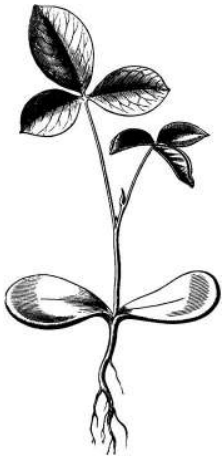
Finally, roots are the storage areas of a plant. They store minerals and carbohydrates for the plant to use as fuel (food) in the future. Root vegetables—such as carrots, radishes, beets, potatoes, and turnips—are examples of roots that store large amounts of food to help the plant parts grow above the ground (green, leafy foliage) and below the ground (roots and root hairs).

After the root develops, the young stem and its leaves will emerge from the seed. The first leaves to form are called ***cotyledons*** or seed leaves. The cotyledons of a bean will be larger and fatter than that of the radish seed, because they store much of the food of the plant. A radish seed will store most of its food in its root, which will eventually grow into the red and white part of the radish that we eat.

Cotyledons: the first leaves to form on a sprouting plant; also called seed leaves.



The leaves of the seedlings spread themselves out horizontally so they can collect more of the sun's light energy. Plants need this energy in order to make their food. The stem or ***shoot*** connects the leaves to the roots and is the pathway for water, nutrients, and food to move throughout the plant. It also provides the support for all parts of the plant that grow above the ground. The stem grows upward toward the sun and will actually move the leaves of a plant to face in the direction of the sun as the Earth turns on its axis and the sun appears to move across the sky.



Seedling

Buds

Lateral buds

Once the roots secure water and are providing stability, ***buds*** form along the stem. Buds will grow into young leaves and more stems, and in some cases, flowers. A terminal bud is at the tip of a stem, and lateral buds grow along the sides of a stem.

A head of cabbage is a large ***terminal bud***. If you cut the head in half from top to bottom, you can see the stem in the center of the bud. The leaves grow out from the stem. If you pull off the leaves, one by one, you will find a very small ***lateral bud*** just above each leaf.

A head of celery is a large, tall bud. If it were allowed to grow for a second year, it would produce flowers and those flowers would produce seeds. If you cut a bunch of celery open, you will notice each stalk of celery with its leafy top is a leaf. The celery heart is the stem. If you remove a stalk from the stem, you can see lateral buds, which sometimes grow into other branches.

Crocus bulb

A ***bulb*** is a large underground bud that can produce new plants. The leaves of a garlic bulb are large and papery. Each of the cloves is a lateral bud. If you cut through a garlic bulb from top to bottom, you can see its leaves and its small stem at the bottom.

Many trees or shrubs (a good example is a lilac) have lateral buds that are protected by special leaves called ***bud scales***. Lateral buds will eventually grow into branches with buds of their own. Usually the

Shoot: the stem of a plant that is just beginning to grow; it connects the roots and the leaves and is the pathway for nutrients to move through the plant.

Buds: the developing part of a plant that will grow into leaves, additional stems, or flowers.

Terminal bud: bud that forms at the tip of a stem.

Lateral bud: a bud that forms along the side of a stem.

Bulb: a large underground bud that can produce new plants.

Bud scales: special leaves that protect lateral buds on certain plants.

most vigorous growth occurs along the terminal bud, as the plant grows vertically toward the sunlight. Should the terminal bud be broken or removed, growth along the lateral buds will increase. When bushes or hedges are pruned or clipped, growth is stimulated in lateral buds so the plant grows bushier instead of taller and thinner.

Assignments

1. Carefully pull up one of each of the seedlings from the last lesson. Notice that they do not look exactly the same, but they are all similar in that they have three main parts. If you have a magnifying glass or a microscope, examine the seedlings' roots to see if you can identify the root hairs. Using the diagrams and text in this lesson, identify each of the parts of each seedling. How are the root structures different? Are they fibrous or taproot systems? Record your observations.
2. For this assignment, you will need a head of cabbage or a Brussels sprout (which is like a tiny cabbage and is closely related), a bunch of celery, and a bulb of garlic. Ask for parental assistance, if needed, to slice each of them in half, top to bottom. Draw a picture of the exposed parts of each and label the parts that you can identify. (Then use the vegetables for your dinner, if you like!)
3. Explain the functions of the parts of a green plant:
    a. Leaves
    b. Stem
    c. Roots
    d. Root hairs
    e. Bud
    f. Bud scale

Choice Assignment

Choose **one** of the following projects.

A. **Inspect Roots.** If you have a yard or access to a nearby field, go outdoors with a trowel or small shovel and find some common grasses and weeds that you can recognize, such as dandelions, clover, and the grass in your lawn or field. Dig up a small clump or a single plant of at least three different types. (Be careful not to break off the root when you dig it up.) Gently shake off the soil and examine the root structures. Look more closely with a magnifying glass. Does it have one main taproot, or many smaller, fibrous roots? Draw a color picture of each plant with its roots and label the type of root structure for each plant. (After you finish, you can replant the plants if they are not too wilted. Be sure to give them some water, as they will have dried out.)

B. **Research Carnivorous Plants!** In the beginning of this lesson, you learned that plants are the only organisms that can make their own food. While this is true, there are some plants that trap and digest other organisms (usually insects). Using books found at your local library, or internet resources, find out what specialized mechanisms these plants have that enable them to capture and eat bugs. Write a three-paragraph paper describing how they do this. Use the names of some of the plants you learned about. Do any of these plants live near you? Have you ever seen any? Please refer to the introduction for suggestions about how to complete a research paper. Don't forget to proofread your work and to write a works cited page.

C. **Identify Edible Roots and Shoots.** Make a list of all the vegetables, grains, and fruits that your family eats. Then take a trip to a grocery store and look for the plants on your list. Try to identify what part of a plant each of the food items represents. Write down the part next to each name. Some foods might be hard to figure out. When you eat broccoli, for example, you are eating clusters of tiny flower buds. If that green broccoli head had been left in the field where it grew, in a few days it would have become a mass of yellow flowers! Which plant parts are there more of on your list? Probably, your family eats a mixture of roots, stems, leaves, buds, flowers, and seeds of all types.

D. **Witness Plant Power.** Try a true test of the amazing power of roots. For this activity you will need several beans, plaster of Paris, and a paper cup. Soak the beans overnight to prepare them.

   When the beans have been soaked, pour plaster of Paris (which should be prepared as a liquid according to the instructions on the package) into a paper cup, filling it about halfway. Then place a few beans on the plaster and continue to fill the cup. Be sure the beans are located halfway down.

   In a few days, you will be witness to a plant's strength and determination to grow! (The plants should have broken through the plaster of Paris. If they did not, be sure you soaked the beans overnight and prepared the plaster correctly.)

Test Questions

1. What are the two main types of root systems? Describe each one in your own words.

2. What are the main functions of roots in green plants? Name and describe three functions.

3. What role do leaves play in the function of a plant?

4. Name at least three parts of plants that are commonly eaten by humans. Give two examples of each.

FOR ENROLLED STUDENTS

Please submit your student's work to your Oak Meadow teacher at the end of this lesson. Make sure all the assignments are completed (you can use the assignment checklist to help you organize your submission). Contact your teacher if you have any questions.

Learning Assessment

Use assessment rubrics to track student progress and to make notes about the learning the student demonstrates or any skills that might need work.

SKILLS	Developing	Consistent	Competent	Notes
Displays focused observation skills				
Records observations in detail				
Collects data over time				
Creates accurate, labeled, scientific drawings				
Demonstrates knowledge of root structure and function in plants				
Identifies functions of roots and leaves				

Lesson

17

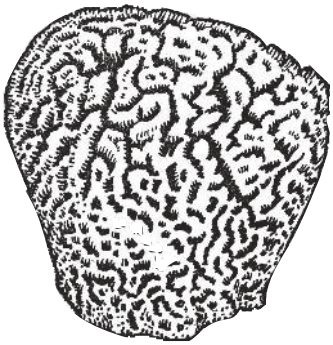
Simple Animals

Most of the Earth's animals are simple animals. To be considered simple, an animal must have only a few body parts. When an animal has few body parts, life is easier in water; in particular, because it is easier to move in water. The very first animals that evolved on Earth were water dwellers. They were related to the enormous variety of simple animals living today. Most of these simple animals have short life spans, often only days or months.

The land animals with which we are most familiar share a similar plan: sensory organs centered on the head, some limbs for moving around, a backbone or spinal cord, etc. Simple animals are often organized very differently and are very diverse in their structures. We won't look at all 35 phyla, but as we introduce you to a few, you'll see there are a lot of ways an animal can be an animal.

Sponges

When you think of a sponge, you probably think of the rectangular absorbent material that soaks up liquids and is made in factories. People got the idea to make sponges from live sponges that were harvested from relatively shallow coastal waters by using a hooked pole. The dried live sponge is actually only the remains of the skeleton, all the active living cells having been washed away. Natural animal sponges can still be bought, but serious fishing for sponges died out in the late 1930s.



Sponge

Sponges belong to the phylum ***Porifera***, which means "having holes." Sponges are full of tiny holes or ***pores***. Pores are a trait of all sponges.

ASSIGNMENT SUMMARY

- ☐ Identify traits and give examples of different types of animals.
- ☐ Draw a picture of a coral reef.
- ☐ Choice assignment
- ☐ Complete lesson 17 test.

MATERIALS

☐ **Choice Assignment**

An Underwater Color Community
fine-tipped marker or pen
crayons or colored pencils

Find Wiggly Worms
plastic or wooden box
25 worms

Porifera: the phylum to which all sponges belong.

Pores: tiny holes that allow liquid and minuscule substances to enter and exit an organism.

They cover the outside of the animal, trapping microscopic foods, such as bacteria, algae, protozoa (small ones), and eggs, as they float or swim by in the water.

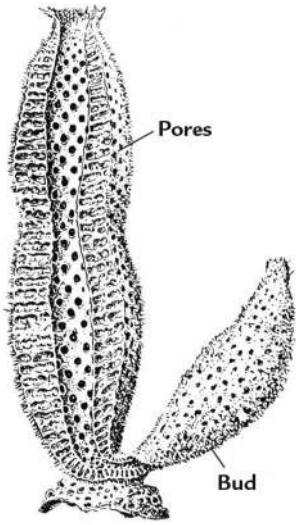
Sponges are different from most other types of animals. As adults, they do not move around on their own. Instead, they attach to surfaces on the ocean or river bottom. They do swim when first hatched from eggs, though.

The body of a sponge is very simple. It has no tissues or organs. Instead, three layers of different types of cells take care of eating, transporting, supporting, and reproducing. The outer layer is thin and flat and protects the inner layers. Food particles enter through the pores, which branch into channels, then travel through the middle layer, made of a jelly-like material. The cells of the middle layer move food throughout the body of the sponge. The cells of the inner layer take the food and oxygen from the water and make hard, needle-like structures called ***spicules*** that form a simple skeleton supporting the body of the sponge. Most kinds of sponges were not harvested for people to use because of their hard sharp skeletons.

Spicules: hard, needle-like structures that form the simple skeleton of a sponge.

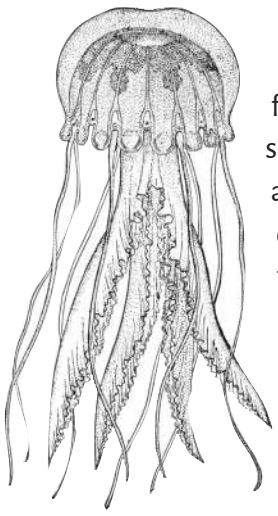
The body of a sponge is closed at the bottom and open at the top, sometimes like a vase or a sack. Inside the sponge are many hollow channels through which waste from the cells pass back into the water and out through the top openings of the sponge. A sponge eats by filtering; it can strain the tiny organisms out of two quarts of water in a minute.

An individual sponge can produce both eggs and sperm to hatch new sponges, but it can also reproduce by budding (as discussed in lesson 12), which is not uncommon in simple animals.



Cross section of a sponge

Coelenterata


Jellyfish

Jellyfish, hydra, corals, and sea anemones all look different on the outside, but inside they all function very similarly. They all belong to the same phylum of animals, ***Cnidaria***. Each of these animals has a ***cavity*** in its center, which has an opening or mouth through which water and food enter and waste exits. These animals also have some type of tentacles that contain stinging cells that are used to catch food. Small animals are killed or stunned by these cells, and the tentacles are then used to push the food through the mouth into the body cavity. Chemicals in the cavity change or digest the

Coelenterata: a term that encompasses animals in the phyla Cnidaria and Ctenophora, all of which are aquatic invertebrates that have a single body opening.

Cnidaria: a phylum that includes animals with stinging tentacles, which are used to catch food.

Cavity: a hollowed-out place within a body.

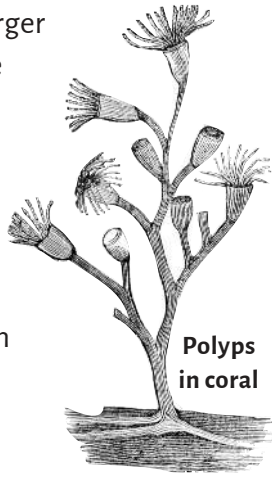
food into forms that the rest of the cells can use so that, unlike the earlier phylum Porifera, cnidarians can eat foods bigger than their cells.

The cells of cnidarians are organized into tissues, another degree of increased complexity over poriferans. Cnidarians all have digestive, muscle, nerve, and sensory tissues, and each of the tissues is made of different types of cells. These traits, along with the hollow body and tentacles, are characteristics of animals of the phylum Cnidaria, and also known as "flowers of the animal kingdom."

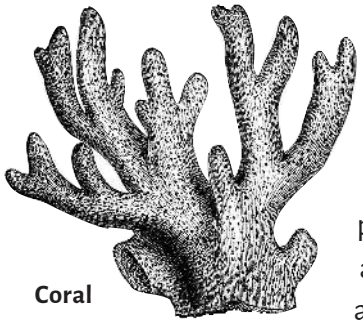
Polyp: a small, flower-like water animal that has a mouth fringed with tentacles and a tube-like body; another term for corals.

Zooplankton: tiny drifting plants and animals that live in the sea.

Let's look at one of the species in this phylum, the small, beautiful, sometimes brightly colored, hard corals. The coral animal, called a ***polyp***, lives in colonies and hides inside a hard skeleton often made of calcium. As generations of polyps grow and die, these skeletons slowly grow larger and larger, forming a coral reef of rock-like material. Each species' skeletons make a different pattern; some are elaborate, some incredibly old and expansive. The Great Barrier Reef along the northeast coast of Australia is over 20,000 kilometers long, and 150 meters thick, and parts of it are 20 million years old; if you were on the moon you would be able to see it!

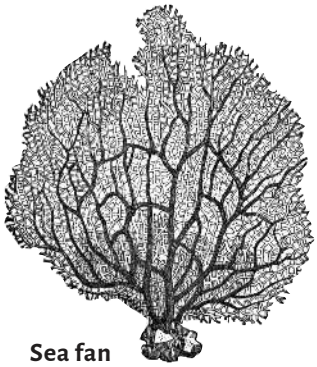


Polyps in coral



Coral

Most species of hard corals reach their tentacles out of their protective houses at night to catch ***zooplankton***, tiny drifting plants and animals that also come out of hiding at night. But corals do not do this alone. Algae live inside them and help by producing food through photosynthesis in exchange for a place to live. Scientists keep discovering more and more housemate-like arrangements between different kingdoms of living organisms.



Sea fan

Soft corals are another kind of coral that do not make a hard skeleton. They live in deeper waters, can be as tall as one meter, and have names to match their beauty—sea plumes, sea feathers, sea fans, sea whips. At rest, soft corals look like blobs, but when the water currents flow, and the polyp wakes up to feed, they stretch and wave their colorful tentacles.

Worms

There are many phyla of worms, each with distinguishing characteristics. Here are descriptions of three: ***Platyhelminthes***, ***Nematoda***, and ***Annelida***. (They all have easy names, too!) Platyhelminthes are

Platyhelminthes: flatworms that have long, flat bodies.

Nematoda: roundworms with long bodies with rounded ends and cross sections.

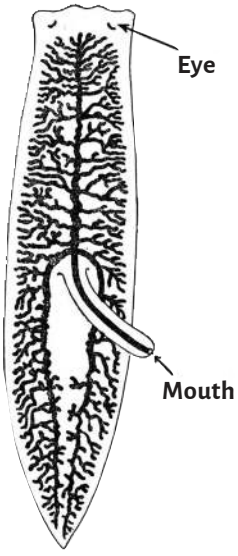
Annelida: segmented worms such as earthworms.

Parasite: organisms that are dependent upon other organisms for food and other survival needs.

Host: an organism who supports a parasite.

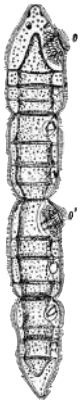
Anus: the opening through which waste matter exits an organism.

flatworms and have long, flat bodies. Nematodes are roundworms with long bodies with rounded ends and cross sections. Annelids are segmented worms like earthworms.

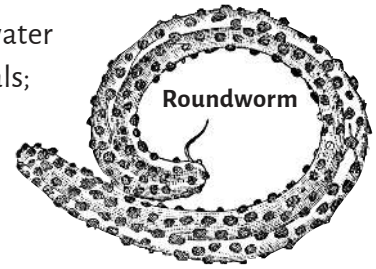


Flatworm parasite

Although the flatworms and roundworms belong to different phyla, they are similar in that most of them grow inside other organisms. Because they depend upon other organisms for the food and other materials that they need to live, they are called ***parasites***. Parasites are organisms that grow on or in the bodies of other organisms, called ***hosts***. Parasites often do some type of harm to their host organism. Tapeworms are parasites, living in the intestines of many animals, including humans. Some flatworms are not parasites; these live in ponds and streams and feed on the tissues of twigs or leaves.


Flatworm

Flatworms are the simplest animals to have an organ system, which makes them a bit more complex than animals in Coelenterata. They have heads with eyespots that can sense light. They have mouths but no rear exit.



Roundworms can live almost anywhere. Most of them live in water or soil. Some are disease-causing parasites of plants or animals; some do no harm—humans eat and drink many nematodes with no ill effect. All roundworms have digestive systems; in fact, they are the simplest animals to have an entire digestive organ system. Food enters through one end of the worm and waste is passed out of the ***anus*** at the other end.


Earthworm

When you think of worms, the animal that usually comes to mind is an earthworm. Earthworms and leeches belong to the phylum Annelida. They are characterized by bodies that are segmented or divided into sections. They also have circulatory systems with hearts that move the blood through blood vessels.

Earthworms are important in many ways. They are food for many animals. They are also important in making soil more fertile. As they move through the soil, earthworms eat partially decomposed plant matter. This food passes through the earthworm's digestive system and out the anus. This waste enriches the soil where earthworms eat and live. Earthworms also form tunnels as they move through the soil, adding air and water that allow plant roots to grow more easily.


Leech

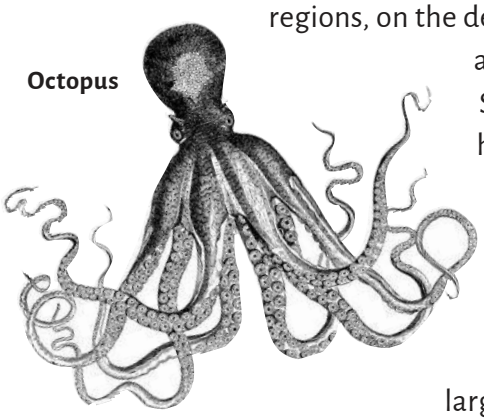
You may not like leeches, but scientists are learning about the different substances that leeches excrete as they suck blood. One keeps blood from clotting, another keeps the

mammal host from feeling the activity. Using leeches, we're learning about blood clotting and treating severely damaged tissues. We can learn from all living things, even unpleasant parasites.

Mollusks

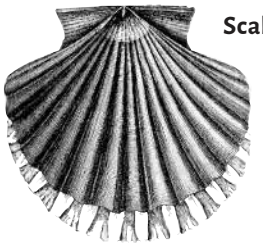
Clams, octopuses, squid, snails, and slugs all belong to the next phylum. ***Mollusca*** is one of the largest and most versatile of any family of animals, and we commonly see many of them. Over 100,000 different species of mollusks live in lots of different places: on land, at high elevations, in the tropics or the polar regions, on the deep ocean floor, and in freshwater. Some mollusks hardly move; others can move fast.

Slug



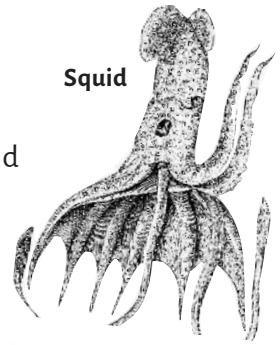
Octopus

The common garden slug is the homely cousin to many kinds of brightly colored and frilled sea slugs. All the pretty and unusual, large and small shells we might find at water's edge are the remains of mollusks. The shy, smart octopus with human-like eyes, and the fast graceful squid are also mollusks.

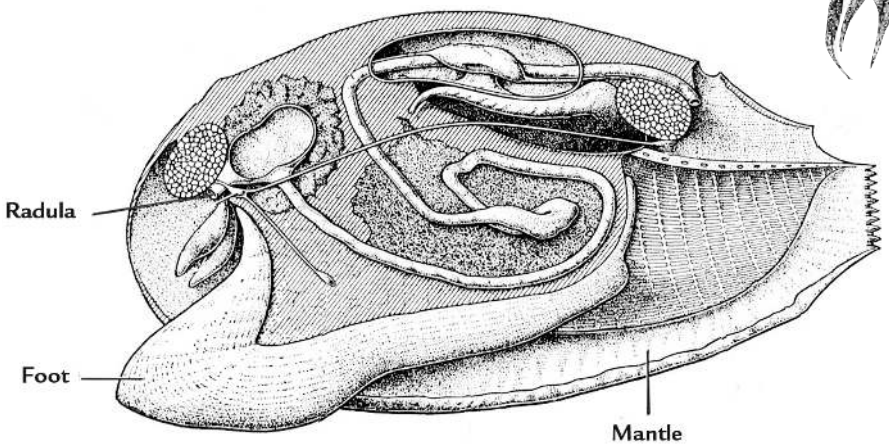


Scallop

Mollusks have soft bodies, circulatory systems, and digestive systems in which a very efficient system has evolved for collecting wastes from body fluids and discharging them out of the body. Three special structures—the ***mantle***, the ***foot***, and the ***radula***—distinguish them from other phyla.



Squid



Interior anatomy of a freshwater mussel

Mollusca: the phylum that includes over 100,000 different species of soft-bodied animals.

Mantle: the layer of skin that surrounds the soft body tissue of a mollusk.

Foot: a wide, flat muscle that mollusks use for movement.

Radula: a mollusk's tongue-like organ used for scraping food from rocks or other objects.

A mantle is a layer of skin that surrounds the soft body tissue. In clams, oysters, mussels, or snails, the mantle produces the hard shell of those animals. In squids and the octopus, the mantle does not harden; it helps the movement of the animal through the water. Slugs don't seem to have shells, but there is a soft one just below the surface.

Most mollusks have a single foot or wide flat muscle that is used for movement, burrowing in the sand or mud as many shelled mollusks do, or creeping along the ground like slugs and snails. In mollusks related to the squid, this foot is divided into tentacles that are used for feeding and for movement. Most mollusks also have a tongue-like organ called a radula that is used for scraping food from rocks or other objects.

Assignments

1. List two important traits of each of the following phyla. (Note the special structures described throughout the lesson that differentiate these phyla from each other.) Give an example of a common animal from each phylum:
   a. Porifera
   b. Cnidaria (or Coelenterata)
   c. Platyhelminthes
   d. Nematoda
   e. Annelida
   f. Mollusca
2. Draw a picture that shows a coral reef. See if you can show it in different stages—show how it forms, how it gets food, and how algae help it. Label your drawing and use colored pencils to make it more realistic.

Choice Assignment

Choose **one** of the following projects.

A. **An Underwater Color Community.** Use the pictures in this lesson and other pictures from resource books to help you with ideas for an underwater scene with sponges, jellyfish, hydra, coral, sea anemones, clams, snails, and worms. You can use a fine-tipped pen or pencil to do your "simple animal" drawings, because they should be accurate in terms of showing each animal's physical features.

   As you are putting your underwater-color-community together, use the information in this lesson to help you figure out what additional plants or animals should be a part of the scene. These additions can be the food sources for the simple animals or other matter they rely upon for survival. Color your scene and label the animals. Imagine you are scuba diving or snorkeling and you can see the animals waving in the flow of the water!

B. **Find Pet Parasites.** Worm parasites are quite common in domesticated animals, such as cats and dogs, due to what they eat, roll in, and sniff. For this activity you will call or visit a local veterinarian to ask about the parasites that affect animals living in homes. Before calling or making an appointment, make a list of at least five questions you have about these parasitic creatures. You might want to inquire about how they affect the health of the animals, if humans can get parasites, how to get rid of them, etc. When you talk to the vet, let them know what you are studying and that you are thankful for the help. When you complete your interview, write up your findings and discuss what you have learned with your home teacher.

C. **Research Species.** Using books found in your local library or from internet resources, research one or two individual species from each of the two groups of phyla below, and write and illustrate one page on each animal:

   1. Platyhelminthes, Nematoda, or Annelida (choose at least one)
   2. Porifera, Cnidoria, or Mollusca (choose at least one)

D. **Find Wiggly Worms.** For those who are daring and worm friendly, here is an activity that involves worm handling. With the help of worms, you can create nutrient-rich soil from your organic waste matter or yard debris. To begin, you will need a plastic or wooden box about the size of a shoebox. For a container this size, you will need about 25 worms; the bigger the box, the more worms you might want to add. If the box is going to be in a place that is warmer than 65°, you will need red worms; if the temperature will be between 50° to 60°, you can use earthworms. You can dig up the worms yourself, buy some from a bait store, or purchase them from a garden center.

   On the bottom of the box, put several inches of shredded newspaper or garden soil and sand. Make sure the base you use is lightly moistened. When the base of newspaper or soil and sand is down, puncture a few air holes in your container and add your worms. Be sure your container closes securely so the worms won't get out.

   You can do this project indoors or outdoors (in warm weather), and the worms should stay put if you are maintaining them with enough materials to make rich garden soil. Add organic matter to your worm box, such as leaves, grass, or fruit or vegetable leftovers (no meat!). You must feed them regularly, but don't overwhelm them with too many food materials. The worms will eat the organic matter, pass it through their digestive system, and "poop" out fertile soil.

   In about two months from the start of your worm-keeping project, the worms will have created a soil that any gardener will be thankful for. You can use the soil or give it away, and continue keeping the worms if you like. Otherwise, let the worms go in a safe place outdoors where they can burrow into soil. Keep a daily log of what you do in your project, and write a full description of what happens as time goes on.

Test Questions

1. Sponges belong to the phylum Porifera. What does this word mean, and how does it describe the anatomy of a sponge?

2. Why do members of the phylum Cnidaria have tentacles that contain stinging cells? How do they use the stinging cells?

3. As you learned, coral reefs are formed by many tiny animals called polyps. How do the polyps get food from the water? How do algae help the polyps?

4. Many types of worms are parasites. What aspect of their behavior classifies them as parasites?

5. Name two ways in which earthworms are beneficial to other organisms.

6. Name two common members of the phylum Mollusca.

FOR ENROLLED STUDENTS

Continue to use the weekly planner, assignment checklist, and learning assessment form to help you organize your lessons and track your student's progress.

Learning Assessment

Use assessment rubrics to track student progress and to make notes about the learning the student demonstrates or any skills that might need work.

SKILLS	Developing	Consistent	Competent	Notes
Creates detailed, labeled scientific drawings				
Differentiates between different types of simple organisms				
Provides specific examples to support statements				

Lesson

23 Ecology and the Environment

We learned in lesson 2 that the environment is made up of everything that is around us, both living and nonliving. The environment contains all the materials and energy needed for living organisms to carry out their life activities.

A fish in its environment

The environment of a fish, for example, consists of water, rocks, pebbles, sand, snails, various invertebrates, and other fish. The light that enters the water, the oxygen gas, and the carbon dioxide dissolved in water are also part of the fish's environment.

The study of living organisms and their environment is called ***ecology***. In studying ecology, we learn how living things are affected by their environment. We also learn how those same living things have effects on their environment. Living things and their environment affect each other; in other words, organisms and their environment are ***interrelated***.

The sciences are classified in much the same way that other topics are grouped. Biology is the study of living things. Geologists study the Earth, and astronomers study the skies. Physics is the study of matter and energy. Often, scientists are even more highly specialized, such as entomologists who study insects, botanists who study plant life, and quantum physicists who study the relationships between the tiniest subatomic particles.

Ecology is different from other sciences in that it deals primarily with how other sciences interconnect—how they are related. Ecology is the study of the areas where other sciences join together. It builds upon the knowledge in all other sciences, by placing the knowledge of other

ASSIGNMENT SUMMARY

- ☐ Choose an animal or plant and describe its habitat.
- ☐ Describe your own personal habitat.
- ☐ Choice assignment
- ☐ Complete lesson 23 test.

MATERIALS

☐ **Choice Assignment**

Video Production
video camera

Nature Drawing
crayons or colored pencils

Ecology: the study of living organisms and their environment.

Interrelated: having a close connection with and affecting each other.

sciences in the context of the "real world." Ecology examines how everything is connected. The discussion in the last lesson concerning the human element in adding complexity to natural food chains shows how information drawn from physics (energy), biology (agriculture), and Earth sciences (climate) all play a part in understanding how the world operates.

Ecosystems

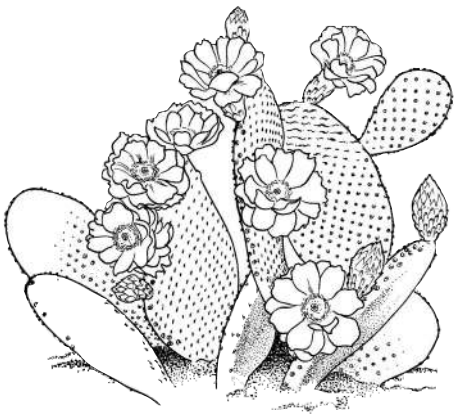
The living and nonliving things in an environment, together with their interactions, are called an ***ecosystem***. Food chains and food webs show some of the most obvious interactions between organisms in an ecosystem. There are many others that are just as important. Decomposers transform dead animals, animal wastes, and plant material into minerals and compounds that enrich the soil and allow grasses, trees, and other producers to grow better. Materials needed by organisms in an ecosystem are used over and over again. While a material is being used by one part of an ecosystem, it is reappearing in another part in a different form. This constant recycling of materials keeps an ecosystem in balance and keeps it and all of its parts healthy.

Ecosystem: the interactions of living and non-living things within an environment.

Habitat

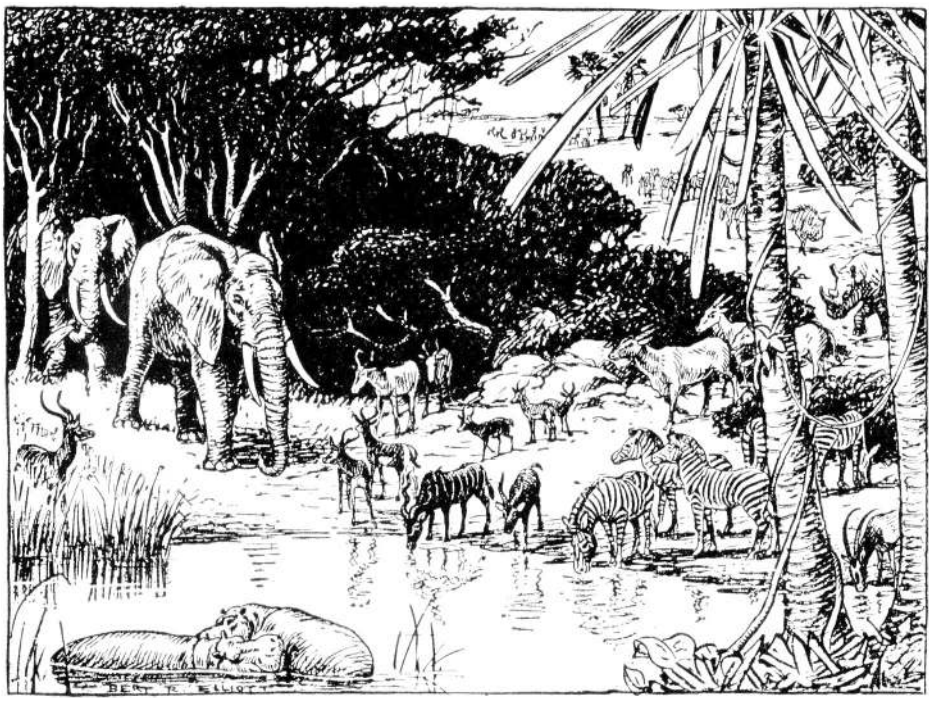
No one organism can spread over all of the Earth. An organism can only live where conditions are right for it. A plant that needs a lot of moisture and warm air cannot live where it is cool and dry. Environmental factors like climate and geography will determine what organisms can live where. For this reason, temperature, moisture, sunlight, and soil types are examples of limiting factors that place limits on where certain organisms can live. For animals, these factors include temperature, water, food, and shelter. Limiting factors also determine the number of any one type of organism that can survive in a given ***habitat***. In an ecosystem, every organism must be in balance with the other creatures that live there. The amount of nonliving resources available, such as water and soil, also must be able to support those living things. If one organism becomes out of balance, everything in the ecosystem is affected. For example, when natural predators such as wolves and coyotes are removed from an area, deer, rabbits, and mice (herbivores) quickly increase in population. This puts stress on other forms of life, such as plant life. In an area with limited plant life, such as a small island, the vegetation can quickly be stripped. Then the deer, rabbits, and mice will have nothing to eat, and they will starve to death. The Earth and all its living organisms have evolved to be in balance with each other, at the same time that everything is moving and flowing and changing!

Habitat: the environment in which all of an animal's needs are met in order for it to live.



Cacti live in dry habitats

All animals have a home, an environment in which they can live. This home is called a habitat. The habitat is the area in which all of an animal's needs are met in order for it to live. There are certain types of water (fresh or salty) in which only certain types of organisms can live. Water can be shallow or deep, swiftly moving or stationary, warm or cold. Each provides a different habitat for different types of organisms.



Water is a valuable nonliving resource in the African Savanna ecosystem

Land also has many different types of habitats. Moles and worms live underground. Centipedes and insects live in holes in rotting trees. Rabbits, chipmunks, and deer live in meadows and woodlands. Some squirrels live their entire lives in the foliage of trees. Some birds nest on cliffs, others in trees. Some very adaptable kinds of birds even nest on man-made structures like bridges and skyscrapers, but this is not their natural habitat!

A squirrel in its habitat

The area where a type of animal or plant is found is called its ***range***. Some animals and plants have large ranges, like birds, bears, and rabbits. But the range of other animals is small. Kangaroos live only in certain parts of Australia. Some animals and plants can survive only in very specific areas. Spotted owls can live only in very old temperate forests with large trees. Many species are endangered because of loss of their specific habitats to roads, buildings, logging, and industrial development. In the United States, many different land areas containing animal and plant habitats have been preserved as public lands.

Range: the area where a type of animal or plant is found.

Assignments

1. Choose an animal or plant and describe its habitat. You can use your own knowledge, or you can conduct research using a book or the internet. Aim to write two or three paragraphs.
2. Describe your own personal habitat. Include all of the elements described in the lesson including sources of food, water, other living organisms, climate, environment, etc.

Choice Assignment

Choose **one** of the following projects.

A. **Video Production.** You will need a video camera for this assignment. As film director for this ecological video, you will need to locate and explore four different habitats before filming. Notice the living and nonliving things in each of these habitats, taking special note of the relationships between different energy sources, the landscape, and the level of sunlight and moisture. Look for both large and small habitats, remembering that even the space under a mushroom cap is a separate mini-habitat.

   After becoming familiar with these places, make your own ecological video with narration. You can put different scenes to music, take on a new voice, or add whatever nature-enhancing aspect you wish. Share the video with your family members and friends.

B. **Nature Drawing.** Go on a habitat expedition outdoors. Look for one animal, one plant, and one nonliving thing's habitat. These can be in different habitats or all in the same one. Carefully observe each habitat. Using crayons or colored pencils, draw each living and nonliving thing in its home, making certain to show any element you think is important to the habitat. While you are reflecting and creating your drawings, think about which one could exist in almost any area in the world. Which could exist in both Antarctica and the state of Florida? Which, if any, could you also find in a desert and in the rain forest? How about a mile down the road? As you are drawing, really think about how your living and nonliving things came to "choose" their particular habitat. Write up your thoughts and share them with your home teacher.

C. **Research Endangered Species.** Do some research to find out about some of the plants and animals that aren't adapting very well to our changing environment, and the loss of their habitats. Choose one or two species and write a short essay about their specific needs, why they have become endangered, and what is being done to help protect them and their habitats. You can use library magazines, nature books, newspaper articles, and nature videos.

Test Questions

1. What do we mean when we say that living and nonliving things in the environment are interrelated?

2. How is the study of ecology different from that of other sciences?

3. Describe, in your own words, what a habitat is.

4. Why does an ecosystem need to be in balance? Give an example of an ecosystem out of balance.

5. An ecosystem needs a source of energy to keep it going. What is the source of energy for all ecosystems? (Hint: We learned this in lesson 22.)

FOR ENROLLED STUDENTS

Please contact your teacher if any questions arise.

Learning Assessment

Use assessment rubrics to track student progress and to make notes about the learning the student demonstrates or any skills that might need work.

SKILLS	Developing	Consistent	Competent	Notes
Demonstrates knowledge of animal habitats				
Shows awareness of role and importance of a balanced ecosystem				
Identifies ways in which an ecosystem can be out of balance				
Shows understanding of relationship between living and nonliving things in an environment				

Appendix

Materials List

Lesson	Assignment Items	Choice Assignment A	Choice Assignment B	Choice Assignment C	Choice Assignment D
Lesson 1	pencil paper two sets of 13–20 items collected from nature				pet
Lesson 2	pencil paper or notebook			blindfold	
Lesson 3	pencil paper	watery environment paper pencil poster-making materials (poster board and crayons, paints, or colored pencils)	4 beans for planting (not treated with any chemicals) nonfertilized soil fertilizer		
Lesson 4		Jell-O Ziploc bag various fruits and nuts glass jar	microscope glass slide onion iodine eyedropper toothpick distilled water food coloring	paints, crayons, or colored pencils	
Lesson 5	11 paper cups good soil 18 radish seeds 12 organic tomato seeds 18 organic lima or organic pole bean seeds shallow saucers or bowls spray bottle pencil paper ruler			raw peanuts paper towels plant pot or half-gallon milk jug sandy potting soil mix	
Lesson 6	magnifying glass or microscope head of cabbage or Brussels sprout bunch of celery bulb of garlic knife	trowel or small shovel	research materials about carnivorous plants		several bean seeds plaster of Paris paper cup

Lesson	Assignment Items	Choice Assignment A	Choice Assignment B	Choice Assignment C	Choice Assignment D
Lesson 7	three different types of fertilizer from a local nursery your own flower or vegetable garden or a person you can interview who has a flower or vegetable garden	clear containers (plastic bags or clear jars) notepad garden soil fruit and vegetable matter grass clippings leaves small twigs nonliving matter such as Styrofoam or plastic		funnel small piece of steel wool (without cleanser in it) clear glass jar water magnifying glass light with an incandescent bulb	
Lesson 8	celery stalk jar water food coloring knife small plastic bag tape or twist-tie	leaves collected from outdoors paint crayons drawing paper			research materials about maple syrup production
Lesson 9	drawing paper baking dish crayons or colored pencils kitchen scale pound of fresh spinach		trees with leaves that will change color in the fall aluminum foil or heavy paper tape watercolor paints or colored pencils	2 clear jars with tight-fitting lids potting soil 8 seeds soaked overnight paper towels	
Lesson 10	large single flower magnifying glass crayons or colored pencils assortment of fruits, vegetables, and seeds (ten items in all)		fresh flowers heavy book newspaper	six fresh flowers magnifying glass sharp knife	
Lesson 11	houseplant sunny window small plant or seedling shoebox	small plant shoe box		research materials on plant hormones	

Lesson	Assignment Items	Choice Assignment A	Choice Assignment B	Choice Assignment C	Choice Assignment D
Lesson 12	carrot magnifying glass potato soil onion (preferably sprouted) soil bread	research materials on mammal gestation	colored pencils or crayons		colored pencils or crayons
Lesson 13			magnifying glass 20-foot piece of string tape measure notebook	49 blank index cards	
Lesson 14	research materials on bacteria and/or fungi		wild mushroom in its natural setting colored pencils or crayons notebook for field observations	access to a local health food store	
Lesson 15	plant specimens from your local area or images of plants from books or the internet		variety of ferns in their local habitat colored pencils or crayons	variety of pine cones colored pencils or crayons	
Lesson 16			research materials on animals around the world		paint, colored pencils, or crayons
Lesson 17		fine-tipped marker or pen crayons or colored pencils			plastic or wooden box 25 worms
Lesson 18	access to a farm, pet store, or animal shelter with a collection of different animals	notebook clipboard pencil or pen	clear plastic bottle organic matter for lining a terrarium arthropods collected from outside	research materials on butterflies paints or colored pencils	
Lesson 19	research materials on birds or reptiles list of animals generated in lesson 18	index cards younger sibling or friend	camera film if using a film camera photo album or handmade book	binoculars bird book	

Lesson	Assignment Items	Choice Assignment A	Choice Assignment B	Choice Assignment C	Choice Assignment D
Lesson 20		poster board colored pencils or crayons family photos		poster board colored pencils or crayons photos	
Lesson 21		4-6 players index cards			
Lesson 22			colored pencils or crayons	index cards tape	food from around the house
Lesson 23		video camera	crayons or colored pencils		
Lesson 24	ruler	string pencil			
Lesson 25					
Lesson 26		index cards assorted foods	old newspapers and/or magazines poster board scissors glue		
Lesson 27	nutrition guide	ingredients for a home cooked meal	poster board colored pencils or crayons	colored pencils or crayons	
Lesson 28	colored pencils or crayons		various breakfast food choices	brazil nut three sewing pins matches metal roasting pan	
Lesson 29	colored pencils or crayons poster board			colored pencils or crayons	
Lesson 30	clock or watch for measuring heart rate	modeling clay			
Lesson 31				magnifying glass two pots and stove	
Lesson 32	large roll of paper	colored pencils, crayons, or paint resource materials on the skeletal system		plaster of Paris sandpaper water newspaper or heavy paper	
Lesson 33	anatomy book or another resource about muscles	journal or notebook	journal or notebook	six volunteers measuring tape, ruler, or tape measure	

Lesson	Assignment Items	Choice Assignment A	Choice Assignment B	Choice Assignment C	Choice Assignment D
Lesson 34		journal or notebook	colored pencils, crayons, or paints research materials on the brain	four volunteers	cookbook cooking supplies
Lesson 35			various items with strong odors paper bags	blindfold	
Lesson 36		colored pencils, crayons, or paints	your schoolwork from this course	paints, a large piece of paper or blank wall	

Citing Your Source

When writing a research report, you should use at least two sources. Of course, you are welcome to use more! Sometimes you will use books, magazines, encyclopedias, newspapers, or the internet to find information. Even though doing research on the internet gives you quick access to a wide variety of sources, it's important to use print sources as well since the information in print is likely to be very carefully checked before publication, while information on the internet can be altered by anyone with computer know-how.

Finding Reputable Sources

Whether you use print or online resources when you conduct research, it is important that you use *reputable* (trustworthy or reliable) sources. Reputable sources undergo extensive review to ensure that the information they provide is accurate. Nonfiction books, encyclopedias, news magazines, professional journals, and newspapers are generally considered reputable. Reputable websites include sites that are connected to reputable print and media sources, such as *newyorktimes.com*, *nationalgeographic.com*, or *cnn.com*. In general, websites that end in *.org*, *.edu*, or *.gov* are considered reputable.

Wikipedia.com is not considered a reputable source by academic standards because anyone can go into Wikipedia and change the entries without having to prove that the information is correct. Wikipedia is a good website for getting a general overview of your topic, and Wikipedia writers often provide a list of the sources they use to write their articles. However, you should never quote directly from Wikipedia, and you should always double check anything you learn on Wikipedia with a reputable source.

Creating a Works Cited Page

Even if you don't quote directly from a source, it's important to keep a list of your sources so that you (or your readers) can go back to them later to check your facts or gain more information. These sources are listed on a works cited page that goes at the end of your paper. In sixth grade, you will begin using the citation format that you will use in high school.