

Oak Meadow

Grade 6

Life Science

Teacher Manual

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Lesson



Science and the Scientific Method

Key Concepts

- Scientific method
 - Question
 - Hypothesis
 - Procedure
 - Observations (results)
 - Conclusions
- Controlled Experiments and Variables
- Sample Experiment: The Effects of Caffeine on Sleep Patterns

ASSIGNMENT SUMMARY

- Analyze caffeine experiment.
- Test your powers of observation.
- Choice assignment
- Complete lesson 1 test.

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.

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.

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?”

This beginning lesson is challenging because it requires developing a scientific way of thinking. Encourage the student as he or she grapples with what may be a new skill.

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 or three to five paragraphs in answer to 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.

In a controlled experiment, all the variables but the one being tested are controlled. This means they are made consistent in every trial. Variables in a plant experiment might include the amount of sunlight, temperature, amount of water, size of pot, or soil composition.

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

Answers will vary. Students are encouraged to think broadly about any topic of interest. They may come up with questions about animal behavior, plant growth, nutrition, bike safety, or any other aspect of their lives. Science is everywhere!

3. Come up with a hypothesis to test each of the three questions you posed in the last question (2).

The hypotheses should be in statement form, expressing an idea that is testable. For instance, a hypothesis such as “My dog likes me better than my sister because I’m the one who feeds him,” is not testable, but “My dog will come when I call more frequently than when my sister calls” is a testable hypothesis. Here are other examples of testable hypotheses:

- A sunflower seed planted in a large pot will grow taller than one planted in a small pot.
- It is easier to focus on a task after eating a snack than when hungry.
- A bicycle is easier to maneuver with a heavy load if the load is carried in a bicycle basket rather than in a backpack worn by the cyclist.

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

1. Question: in order to form a hypothesis, a question is asked about a phenomenon or behavior that has been observed.

2. Hypothesis: the hypothesis is an educated guess as to the cause or reason for the unexplained behavior or phenomenon.

3. Procedure: a controlled experiment must be developed and performed which reduces or eliminates the variables in order to increase the veracity of the results.

4. Observations or results: data from the experiment are recorded.

5. Conclusion: a conclusion is developed based on interpretation of the results.

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

Results are the recorded observations from an experiment. A conclusion is an interpretation of the meaning of the results.

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 the weekly student planner found in the English coursebook to help your student develop time management skills and begin taking responsibility for getting his or her 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.

SCIENCE	Not Yet Evident	Developing	Consistent	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



The Environment

Key Concepts

- Environment
- Observation and Change

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.

ASSIGNMENT SUMMARY

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

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.

Ideally, the student will have a chance to experience the environment as a whole before reflecting on the specifics. That is why we ask the student to take notes and record observations and feelings *after* the experience of being in each place, rather than during. Be sure that the student keeps a copy of this observation to use in the next lesson.



Choice Assignment.

These activities will give you practice in making observations. Please choose one.

- 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 should take five minutes to take in what is around them. The partners then can 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.

The environment refers to everything around us. Students will hopefully be able to convey that in their responses.

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?)

Students may mention reacting to changes in the weather, in the daylight, or in the social environment (such as acting differently when playing with friends or visiting with grandparents). Students should provide specific examples with their answer.

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?)

Yes, all living things change. Examples mentioned might include seeing leaves change color and fall off trees, wildlife growing fatter in preparation for winter, children growing taller, or grass growing longer.

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?)

Nonliving things often change very slowly, but examples might include the shape of a coastline or river after a storm or rainy season, a rotting tree stump being slowly decomposed, a crack in a boulder or sidewalk widening as a plant pushes through it, or the shape of a sand dune changing over time.

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, the weekly planner, and the 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.

SCIENCE	Not Yet Evident	Developing	Consistent	Notes
Displays focused observation skills				
Records observations in detail				
Shows awareness of change in the natural world				

Lesson



Biology

Key Concepts

- Biology and Ecology
- Characteristics of Living Things:
 - Are Made of Cells
 - Are Organized on Different Levels
 - Use Energy (metabolism)
 - Reproduce
 - Maintain Stable Internal Conditions (homeostasis)
 - Have Inherited Traits (heredity)
- Additional Characteristics of Living and Nonliving Things:
 - Movement
 - Response to Environment
 - Growth and Development

ASSIGNMENT SUMMARY

- Make a list of requirements for survival.
- Describe characteristics that contribute to an organism's success.
- Choice assignment
- Complete lesson 3 test.

Your Thoughts

Before you read ahead, take a few minutes to think about the differences between living and nonliving things. How do we know something is alive? What characteristics do living things share? Is water living or nonliving? What about soil? Discuss your ideas with someone, and then continue reading to see how well your answers match up with the information in the next few sections.

Assignments

1. You are a living organism. If you could not get all the things that you need from your environment, you would not survive. Make a list of at least six things that you require for your own survival. Discuss your ideas with your home teacher.

An organism's life depends on getting enough heat, water, and energy (in the form of food). The student may note that he or she needs food, clothing, water, and shelter, and may also include other "needs" such as friends, music, books, fun, or exercise. Consider how these specifics fit into the basic requirements of all organisms.

2. Some living organisms are more "successful" in meeting their needs than others. Usually these organisms are, therefore, present in great numbers. For example, rats are very common animals in many different environments all over the world. On the other hand, the Florida panther is nearly extinct. Think of an organism that is very common in your area, and write a paragraph describing the abilities and characteristics of that organism that might contribute to its "success." Think of another organism that is rare, and write a second paragraph describing some of the possible reasons for the limited success of that organism.

The student may be able to use the observations from lesson 2 in this assignment, identifying a common organism that is successful in the environment. For instance, if a squirrel was observed eating or gathering acorns, the student might explain how the squirrel's ability to move quickly keeps it safe on the ground, the availability of food helps it stay healthy, and its ability to climb trees easily lets it nest safely high off the ground.

Examples of rare organisms might include animals that only eat a certain type of food that is hard to find; if that one food doesn't grow well in a particular year due to drought, flooding, early frost, or any other phenomenon, the animal would be in danger of starving. Another reason animals might be rare is due to a shrinking habitat caused by human encroachment.



Choice Assignment Choose **one** of the following projects.

- A. **Living and Nonliving Things in Watery Environments** If there is a pond, lake, ocean, swamp, brook, or other body of water near your home, spend at least a half hour observing it through the use of your sight, touch, hearing, and smell. What living things do you observe? What nonliving things are present? How are they dependent upon each other? Take notes and/or make sketches about your observations, and then create a poster-size drawing of the natural body of water that you studied. Label the living and non-living parts with their names and note whether they are living or nonliving. Use paints, crayons, or colored pencils to color the drawing. Interestingly, some parts may be difficult to decide whether they are living or not. For example, water itself is non-living but may be filled with tiny, living aquatic organisms as well as larger organisms such as fish.

- B. **Bean Plants** Plant four beans in four different pots with the same kind of nonfertilized soil. Do an experiment to test the requirements for survival for the bean plants. Be sure to follow the format for the scientific method that you learned in lesson 1. Include all five steps: question, hypothesis, procedure, observations, and conclusion.

For this experiment, you will give one plant fertilizer, light, and water, and another plant none of these things. For the other two pots, treat each of them with some of the things you think they need to grow, but omit one or two other things. Observe your plants for a week (this is your procedure). Write down what you think will happen (this is your hypothesis); make a chart about what actually does happen (these will be your observations). Record your observations for the next two weeks.

Make sketches of the pots and their contents before ending your experiment. Some examples of beans you can use are lima beans, pinto beans, kidney beans, string beans (if you have a garden, you may be able to use some leftover bean seeds), or any large bean seed that has not been treated with chemicals to prevent germination. Write up your conclusions based on your observations. Were you able to determine whether some things are more important than others in the survival of your particular bean plants? Write up your experiment into a report and discuss your findings with your parent or tutor.

Test Questions

1. Write a definition of biology in your own words.

Biology is the study of living organisms.

2. List and describe the characteristics of all living organisms.

Living things:

- are made of one or more cells.
- are organized on different levels (such as blood, bones, heart, and brain).
- use energy (transform the sun's energy, food, and water into usable energy through the process of metabolism).
- reproduce (or have the ability to reproduce).
- maintain stable internal conditions, called homeostasis (keep a consistent shape, regulate temperature and other life sustaining conditions).
- have inherited traits (characteristics of the parent organism are passed to the offspring through heredity).

3. What is the difference between movement in a nonliving thing and movement in a living organism? Explain your answer and provide examples.

Nonliving things move because an outside force or energy propels them. Living things move of their own volition or will. This is because a nonliving thing cannot produce its own energy, and a living organism can.

4. Can nonliving matter grow or reproduce? Explain your answer and provide examples.

Nonliving things can never really grow or reproduce, but they can change form and appear to develop, as in the case of crystal formation or an icicle forming and growing in size. When a chunk of rock breaks off a boulder or a chunk of ice breaks off a glacier (“calving”), a smaller version of it is made, but it is not reproducing offspring that have the potential to grow into maturity.

For Enrolled Students

At the end of the next lesson, you will be submitting work to your Oak Meadow teacher. Continue documenting your student’s process with the assignment summary checklist, weekly planner, and the learning assessment form. Feel free to contact your teacher if you have any questions about the assignments or the learning process.

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.

SCIENCE	Not Yet Evident	Developing	Consistent	Notes
Identifies requirements for human survival				
Shows understanding of role of environment in survival				
Identifies characteristics that contribute to the success of an organism				
Differentiates between living and nonliving organisms				
Identifies characteristics of living organisms				