Biology for the Logic Stage
Teacher Guide
Biology for the Logic Stage Teacher Guide

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Biology for the Logic Stage
Introduction

In *Success in Science: A Manual for Excellence in Science Education*, we state that the middle school student is “a bucket full of unorganized information that needs to be filed away and stored in a cabinet.”¹ The goals of science instruction at the logic level are to begin to train the students’ brains to think analytically about the facts of science, to familiarize the students with the basics of the scientific method through inquiry-based techniques, and to continue to feed the students with information about the world around them. *Biology for the Logic Stage* integrates the above goals using the Classic Method of middle school science instruction as suggested in our book. This method is loosely based on the ideas for classical science education that are laid out in *The Well-Trained Mind: A Guide to Classical Education at Home* by Jessie Wise and Susan Wise Bauer.

This guide includes the four basic components of middle school science instruction as explained in *Success in Science*.

1. **Hands-on Inquiry** – Middle school students need to see real-life science, to build their problem-solving skills, and to practice using the basics of the scientific method. This can be done through experiments or nature studies. In this guide, the weekly experiments fulfill this section of middle school science instruction.

2. **Information** – Middle school students need to continue to build their knowledge base, along with learning how to organize and store the information they are studying. The information component is an integral part of this process. In this guide, the reading assignments, vocabulary and sketches contain all of the necessary pieces of this aspect of middle school science instruction.

3. **Writing** – The purpose of the writing component is to teach students how to process and organize information. You want them to be able to read a passage, pull out the main ideas and communicate them to you in their own words. The assigned outlines or reports in this guide give you the tools you need to teach this basic component to the students.

4. **The Science Project** – Once a year, all middle school students should complete a science project. Their projects should work through the scientific method from start to finish on a basic level, meaning that their questions should be relatively easy to answer. The science fair project, scheduled as a part of unit five, fulfills the requirements of this component.

*Biology for the Logic Stage* also includes the two optional components of middle school science instruction, as explained in *Success in Science*.

1. **Around the Web** – Middle school students should gain some experience with researching on the Internet. So for this optional component, the students should, under your supervision, search the Internet for websites, YouTube videos, virtual tours and activities that relate to what they are studying. In this guide, the “Want More” lessons recommend specific sites and activities for you to use.

2. **Quizzes or Tests** – During the middle school years it is not absolutely necessary that you give quizzes or tests to the students. However, if you want to familiarize them with test-

taking skills, we suggest that you give quizzes or tests that will set the students up for success. With that in mind, we have included optional tests for you to use with each unit.

My goal in writing this curriculum is to provide you with the tools to explore the field of biology while teaching the basics of the scientific method at the middle school level. During these years, the students’ will work on their observation skills, learn to think critically about the information they are studying, and practice working independently. *Biology for the Logic Stage* is intended to be used with fifth through seventh grade students.

**This Guide in a Nutshell**
This guide includes the weekly student assignment sheets, all the sketches pre-labeled for you, and discussion questions to help you guide the discussion time. This guide also contains information for each experiment, including the expected results and an explanation of those results. There is a list of additional activities that you can choose to assign for each week. Finally, this guide includes possible schedules for you to use as you guide the students through *Biology for the Logic Stage*.

**Student Guide**
The Student Guide, which is sold separately, is designed to encourage independence in the students as they complete *Biology for the Logic Stage*. The Student Guide contains all the student assignment sheets, pre-drawn sketches ready for labeling, experiment pages and blank report pages. The guide also includes blank date sheets as well as all the sheets they will need for the Science Fair Project. In short, the Student Guide contains all the pages the students will need; it is essential for successfully completing this program.

**Student Assignment Sheets**
This Teacher Guide contains a copy of each of the student assignment sheets that are in the Student Guide. This way you can stay on top of what the students are studying. Each of the student assignment sheets contains the following:

- **Experiment**

  Each week will revolve around a weekly topic that is to be studied. The students will be assigned an experiment that poses a question related to the topic. Each of these experiments will walk the students through the scientific method (see the Appendix pg. 246 for a brief explanation of the scientific method). In a nutshell, the scientific method trains the brain to examine and observe before making a statement of fact. It will teach the students to look at all the facts and results before drawing a conclusion. If this sounds intimidating, it’s not. You are simply teaching the students to take the time to discover the answer to a given problem by using the knowledge they have and the things they observe during an experiment.

  Each week, the student assignment sheet will contain a list of the materials needed and the instructions to complete the experiment. The Student Guide contains an experiment sheet for the students to fill out. Each experiment sheet contains an introduction, which is
followed by a list of materials, a hypothesis, a procedure, an observation and a conclusion section. The introduction will give the students specific background information for the experiment. In the hypothesis section, they will predict the answer to the question posed in the lab. In the materials listed section, the students will fill out what they will use to complete the experiment. In the procedure section, they will recount step-by-step what was done during their experiments, so that someone else could read their reports and replicate their experiments. In the observation section, the students will write down what they saw. Finally, in the conclusion section they will write whether or not their hypotheses were correct and share any additional information they have learned from the experiments. If the students’ hypotheses were not correct, discuss why and have them include that on their experiment sheets.

Vocabulary and Memory Work

Throughout the year, the students will be assigned vocabulary for each week. They will need to write out the definitions for each word on the Unit Vocabulary Sheet found in the Student Guide on the week that they are assigned. You may want to have the students also make flash cards to help them work on memorizing the words. This year, the students will also memorize several lists of facts that correspond to each unit. There is a complete listing of the vocabulary words and memory work for each unit on the unit overview sheet in this guide, along with a glossary and a list of the memory work in the Student Guide.

Sketch

Each week the students will be assigned a sketch to complete and label. The Student Guide contains an unlabeled sketch for them to use. They will color the sketch, label it and give it a title according to the directions on the Student Assignment Sheet. The information they need will be in their reading, but the sketch is not always identical to the pictures found in the encyclopedia. As a result, these sketch assignments should make the student think. This guide contains a completed sketch for you to use when checking their work.

Writing Assignments

Each week the students will be assigned pages to read from one of the spine texts, either in *The Usborne Science Encyclopedia* or in *The Kingfisher Science Encyclopedia*. Have them read the assigned pages and discuss what they have read with you. After you have finished reading and discussing the information, you have three options for the students’ written assignments:

- **Option 1: Have the students write an outline from the spine text**
  A typical fifth grader completing this program should be expected to write a two to three level outline for the pages assigned for the week. This outline should include the main point from each paragraph on the page as well as several supporting and sub-supporting points;

- **Option 2: Have the students write a narrative summary from the spine text**
  A typical fifth grader completing this program should be expected to write a three to six paragraph summary (or about a page) about what they have read in the spine text;

- **Option 3: Have the students write both an outline and a written report**
  First, have the students read the assigned pages in the spine text. Then, have them write a two to three level outline for the assigned pages. Next, have the students do
some additional research reading on the topic from one or more of the suggested reference books listed below. Each topic will have pages assigned from these reference books for their research. The following encyclopedias are scheduled to be used as reference books:

- **The Usborne Science Encyclopedia, 2015 Edition** (USE) – This resource is good for most fifth and sixth graders. It is also the spine text for Units 1 and 2 of this study.
- **The Kingfisher Science Encyclopedia, 2017 Edition** (KSE) – This resource is a slightly more advanced reference work than *The Usborne Science Encyclopedia*. It is also the spine text for unit 6 of this study.
- **DK Encyclopedia of Nature, 2007 Edition** (DKEN) – This resource is good for most fifth through seventh graders. It is on the same level as *The Kingfisher Science Encyclopedia*, but it can be difficult to find as it goes in and out of print.
- **Usborne Illustrated Dictionary of Science, 2012 Edition** (UIDS) – This resource is approaching the high school level.
- **DK Eyewitness Book: Human Body, 2014 Edition** (DK HB) – This resource is only for the human body study and is also approaching the high school level.

Once the students complete the additional research reading, have them write a report of three to four paragraphs in length, detailing what they have learned from their research reading. Your writing goal for middle school students is to have them write something (narrative summary, outline, or list of facts) every day you teach school, either in science or in another subject. The writing option you choose for this curriculum will depend on the writing the students are already doing in their other subjects.

When evaluating the students’ reports, make sure that the information they have shared is accurate and that it has been presented in a grammatically correct form (i.e. look for spelling mistakes, run-on sentences, and paragraph structure). In the Student Guide, there are two blank lined sheets for the students to use when writing their outlines and/or summaries. If you are having the students type their reports, have them glue a copy into their Student Guide.

**Dates**

Each week the dates of important discoveries within the topic and the dates from the readings are given on the student assignment sheet. The students will enter these dates onto one of their date sheets. The date sheets are divided into the four time periods as laid out in *The Well-Trained Mind* by Susan Wise Bauer and Jessie Wise (Ancients, Medieval-Early Renaissance, Late Renaissance-Early Modern, and Modern). Completed date sheets are available for you to use in the Appendix of this guide, on pp. 243-245.

**Schedules**

*Biology for the Logic Stage* is designed to take up to three hours per week. You and the students can choose whether to complete the work over five days or over two days. Each week I have included two scheduling options for you to use as you lead them through this program. They are meant to be guides, so feel free to change the order to better fit the needs of the students. I also
recommend that you begin to let them be in charge of choosing how many days they would like to
do science, as this will help to begin to foster independence in their school work. I have included
two blank scheduling templates for you to use in the Appendix of this guide on pp. 255-256.

Additional Information Section
The Additional Information Section includes tools that you will find helpful as you guide the
students through this study. It is only found in the Teacher Guide, and it contains the following:

ativas are totally optional. The “Want More” activities are
designed to explore the science on a deeper level by researching specific topics or through
additional projects to do. The students do not have this information in their guides, so it is up
to you whether or not to assign these.

Several of the “Want More” activities require materials that would need to be purchased
from a lab science supply company. The following companies are good places to look for
these materials:

3. Carolina Biological Supply Company (http://www.carolina.com)

Since you will need to purchase a frog dissection kit for Week 19 from one of these
companies, I have also included a list of the optional dissections that you can get from a lab
supply company for the optional “Want More” activities for your reference:

- **Week 12**: Earthworm dissection kit
- **Week 13**: Starfish dissection kit
- **Week 20**: Owl pellet dissection kit
- **Week 29**: Sheep’s brain dissection kit
- **Week 31**: Sheep’s heart dissection kit
- **Week 34**: Sheep’s kidney dissection kit
Sketch
Each week, the Additional Information Section includes copies of the sketches that have been labeled. These are included in this guide for you to use as you correct the students’ work.

Tests
The students will be completing a lot of work each week that will help you to assess what they are learning, so testing is not absolutely necessary. However, I have included end-of-unit tests that you can use with the students if you feel the need to do so. The tests and the answers to them are included after the material for each unit in this guide, with the exception of Unit 6. Unit 6 has two tests, one mid-unit test that covers the first five weeks and one end-of-unit test that covers the last five weeks. You can choose to give the tests orally or copy them for the students to fill out.

What a typical two-days-a-week schedule looks like
A typical two-day schedule will take one to one-and-a-half hours per day. Here is a breakdown of how a normal two-days-a-week schedule would work using week one as an example:

Day 1: Define the vocabulary, do the experiment, complete the experiment sheet, and record the dates
Begin day 1 by having the students do the “What do plant cells look like?” experiment. Have them read the introduction and then perform the experiment using the directions provided. Next, have them draw what they see, discuss their results with you and then write a conclusion for their experiment. Finish the day by having them look up and define “cell” and “mitosis” using the glossary in the Student Guide and add the dates to their date sheets.

Day 2: Read the assigned pages and discuss together, prepare an outline or narrative summary and complete the sketch
Begin by having the students read pp. 250-251 and 298-299 of the Usborne Science Encyclopedia. Then, using the questions provided, discuss what they have read. Have them complete the sketch using the directions on the Student Assignment Sheet. Finally, have them write an outline or narrative summary. Here is what that could look like:

Sample one-level outline of the spine text for Week 1
I. Cells are the basic building blocks of life.
II. Animal cells have a thin outer membrane and have specialized structures inside called organelles.
III. Plant cells differ from animal cells because they have a tough outer membrane and contain chloroplasts.
IV. Cells can work together.
V. Cells reproduce through a process called mitosis.

Sample Narrative Summary from the spine text only for Week 1
Cells are the basic building blocks of all living things. They are controlled by genes called DNA. Cells can work together in a multicellular organism. They reproduce through a process called mitosis.
Animal cells are usually soft and flexible. They have a thin outer membrane and are filled with a jelly-like substance called cytoplasm. The cytoplasm contains small structures called organelles. The organelles carry out many functions in the cell, such as making proteins.

Plant cells differ from animal cells in several ways. They have an additional outer membrane, which is tough. A plant cell is rigid due to pressure from the inside. Also, plant cells contain chloroplasts, which are necessary for photosynthesis.

What a typical five-days-a-week schedule looks like

A typical five-day schedule will take thirty to forty-five minutes per day. Here is a breakdown of how a normal five-days-a-week schedule would work using week one as an example:

**Day 1: Do the experiment and complete the experiment sheet**
Begin day 1 by having the students do the “What do plant cells look like?” experiment. Have them read the introduction and then perform the experiment using the directions provided. Next, have them draw what they see, discuss their results with you, and then write a conclusion for their experiment.

**Day 2: Read the assigned pages, discuss together and write an outline or list of facts**
Begin by having the students read pp. 250-251 and 298-299 of the Usborne Science Encyclopedia. Discuss what they have read using the provided questions. Then, have the students write a two to three level outline, and complete the sketch using the directions on the Student Assignment Sheet. Here’s a sample list of facts:

**Sample list of facts from the spine text for Week 1**
1. Cells are the basic building blocks of life.
2. Animal cells have a thin outer membrane and have specialized structures inside called organelles.
3. Plant cells differ from animal cells because they have a tough outer membrane and contain chloroplasts.
4. Cells can work together.
5. Cells reproduce through a process called mitosis.

**Day 3: Record the dates, define the vocabulary and complete the sketch**
Begin by having the students look up and define “cell” and “mitosis” using the glossary in their guide. Have them add the dates to their date sheets. Then, have them complete the sketch using the directions on the Student Assignment Sheet.

**Day 4: Read from the additional reading assignments and prepare a written report**
Begin by having the students read pp. 238-240 about the parts of the cell in the The Usborne Illustrated Dictionary of Science. Then, have them use their outline or list of facts along with what they have just read, to write a two to four paragraph summary of what they have learned. Here’s a sample of what that summary could look like:

**Sample Written Report for Week 1**

Cells are the basic building blocks of life from which every living thing is made. There are many different types of cells that
work together to keep an individual alive. Cells perform all the processes necessary for life, such as absorbing food and minerals, removing waste and producing energy. They are constantly making copies of themselves, through mitosis, so that the new cells can replace ones that die.

Animal cells have a nucleus and cell membrane. Inside they are filled with a substance called cytoplasm, which contains a number of organelles. Organelles each have different functions, such as the mitochondria that convert simple substances into energy that can be used by the cell. Animal cells work together to form tissues, tissues work together to form organs, organs work together to form systems and systems work together to form an individual.

Plant cells are a little larger than animal cells, but they also contain several unique structures. The first is the cell wall, which is a rigid outer layer made of cellulose. The second are chloroplasts, which contain chlorophyll, a chemical that helps to produce food for a plant. Plant cells also have a sap-filled vacuole, chromoplasts, a cell membrane and a nucleus. Plant cells work together to form three main plant tissues.

Day 5: Complete one of the “Want More” activities

Have the students look at some pre-prepared slides that came with your microscope or make a replica of a cell with Jell-O. You could also have them read about a scientist from the field of biology.

The Science Fair Project

I have scheduled time for the students to complete a science fair project during Unit 5. Janice VanCleave’s A+ Science Fair Projects and Janice VanCleave’s A+ Projects in Biology: Winning Experiments for Science Fairs and Extra Credit are excellent resources for choosing project topics within the field of biology. You can call your local school system to see if it allows homeschooled students to participate in the local school science fair, or you can get information on national science fairs from them. Another option would be to have the students present their projects in front of a group of friends and family.

How to Include Younger Students

I recognize that many homeschool families have a range of different student ages. If you wish to have all the students studying the topic of biology, you have two options for the elementary students when using this program with the middle school students:

Option 1: Have the younger students use Biology for the Grammar Stage

I recommend this option if the younger students are in K through second grade and/or the older student is ready for some independence. You will need to rearrange the units in Biology for the Logic Stage so that all the students will remain on similar topics. The older students will do Unit 1, Units 3 through 5, then Unit 6, and finish with Unit 2.

Option 2: Have the younger students use Biology for the Logic Stage along with the older students

I recommend this option if the younger students are in second through fourth grade and/or
the older students are not ready to work independently. You will need to adjust the workload for the younger student. Here are some suggestions on how to do that:

- Have them watch and observe the experiments, but do not require the younger students to predict the outcome of the experiment (hypothesis);
- Add in some picture books from the library for each of the topics;
- Read the reading assignments to them and have them narrate them back to you;
- Let the younger students color the sketches and then tell them how to label them.

As for the reading assignments, you may find that the spines scheduled are too much for the younger students. If so, you can use the following books instead:

- *DK Encyclopedia of Animals, 2006 Edition*
- *DK First Human Body Encyclopedia, 2005 Edition*

I have included a chart coordinating these resources in the Appendix of this guide, on pp. 248-250.

**Helpful Articles**

Our goal is to provide you with the information you need to be successful in your quest to educate your students in the sciences at home. This is the main reason we share tips and tools for homeschool science education at our blogs. As you prepare to guide your students through this program, you may find the following articles from there helpful:

- **Classical Science Curriculum for the Logic Stage Student** – This article explains the goals of logic stage science and demonstrates how the classical educator can utilize the tools they have at their disposal to reach these goals.
  

- **Scientific Demonstrations vs. Experiments** – This article shares information about these two types of scientific tests and points out how to employ scientific demonstrations or experiments in your homeschool.
  
  - [https://elementalscience.com/blogs/news/89905795-scientific-demonstrations-or-experiments](https://elementalscience.com/blogs/news/89905795-scientific-demonstrations-or-experiments)

- **A Simple Explanation of the Scientific Method** – This article details the steps of the scientific method, along with why it is so important to teach.
  

**Additional Resources**

The following page contains quick links to the activities suggested in this guide along with several helpful downloads:

- [https://elementalscience.com/blogs/resources/bls](https://elementalscience.com/blogs/resources/bls)

**Final Thoughts**

If you find that this program contains too much work, please tailor it to the needs of your students. As the author and publisher of this curriculum I encourage you to contact me with any questions or problems that you might have concerning *Biology for the Logic Stage* at support@elementalscience.com. I will be more than happy to answer them as soon as I am able. I hope that you and your students enjoy *Biology for the Logic Stage*!
Book List

The following books were used when planning this study:

**Encyclopedias for Reading Assignments**

The following books are the main spines of this program. You will need to purchase both of these to complete the reading assignments scheduled in this program. (Note—The editions noted here are the most current editions. However, the past two editions of each of these spines will also work.)

- The Usborne Science Encyclopedia, 2015 Edition (USE)
- The Kingfisher Science Encyclopedia, 2017 Edition (KSE)

**References for Reports**

The following encyclopedias are scheduled for additional reference reading. They are optional, but I suggest that you purchase one or two to use throughout the year. With the exception of the Human Body book, these encyclopedias will be scheduled in subsequent logic stage programs.

- Usborne Illustrated Dictionary of Science, 2012 Edition (UIDS) – This resource is approaching the high school level.
- DK Encyclopedia of Nature, 2007 Edition (DKEN) – This resource is good for most fifth through seventh graders. It is on the same level as The Kingfisher Science Encyclopedia, but it can be difficult to find as it goes in and out of print.
- DK Eyewitness Book: Human Body, 2014 Edition (DK HB) – This resource is only for the human body study and is also approaching the high school level. (Caution – This book is very graphic and is not for sensitive children.)

**Experiment Equipment**

If you would like to create a more lab-like experience for the students this year, I suggest using equipment that is more commonly found in the laboratory setting. Here’s a list of material that you can substitute:

- **Jar** – Use a beaker or Erlenmeyer flask that is at between 750 and 1000 mL;
- **Cup** – Use a beaker or Erlenmeyer flask that is at between 200 and 500 mL;
- **Bottle** – Use an Erlenmeyer flask that is between 250 and 1000 mL;
- **Small cup** – Use a small beaker (50 mL) or test tube;
- **Eye dropper** – Use a pipette.

You can use the glass or plastic version of each of the above.

**Safety Advisory**

Some of the experiments in this book use boiling water or open flames. We recommend that the students use safety glasses and protective gear with each experiment to prevent accidents. Do not allow the students to perform any of the experiments marked “⚠️ CAUTION” on their own.
Microscope Information

What to look for when buying a microscope

When purchasing a microscope for homeschool use, look for the following specs:

- A compound monocular microscope;
- A microscope with 4x, 10x, and 40x objective lenses at a minimum (Note—The eyepiece should also give 10x magnification, which then will allow you to look at an object at 40x, 100x, and 400x magnification.);
- A microscope with separate coarse and fine adjustment knobs;
- A good light source. (Note—The best light sources are an LED or cool fluorescent bulb. Do not get one with mirror illumination, as they are very difficult to adjust.)

You can purchase a good quality microscope at Lab Essentials, Inc. (www.labessentials.com), Children’s Microscopes (www.childrensmicroscopes.com) or Home School Science Tools (www.hometrainingtools.com). Be sure to also purchase some blank slides so that you can make your own slides. For more information on purchasing a microscope, listen to the following podcast:


How to use a microscope

To learn how to use a microscope before you have to teach it, see these articles:

- [http://www.microscope-microscope.org/basic/how-to-use-a-microscope.htm](http://www.microscope-microscope.org/basic/how-to-use-a-microscope.htm)

Experiments that use a microscope

The following weeks will require the use of a microscope to complete the experiment:

- **Week 1**: What do plant cells look like?
- **Week 7**: Can I grow algae?
- **Week 8**: Observation of a fern
- **Week 9**: Dissection of a flower

What if I can’t afford to purchase a microscope?

If you cannot afford to purchase a microscope or are unable to borrow a microscope, don’t worry: the students can still complete the experiments scheduled in this program. I have included links to websites where you can view the assigned slides in the “Additional Information” section in this guide. You can also Google the sample name along with “microscope” to find additional pictures.

Additional activities that will use a microscope

The following weeks have optional Want More activities that will require the use of a microscope:

- **Week 1** (Any type of cells; plant cells)
- **Week 13** (Water hydra)
- **Week 27** (Hair and skin)
- **Week 28** (Bone cells)
- **Week 29** (Muscle cells)
- **Week 32** (Red blood cells)
Sequence of Study

Introductory & Plant Units (11 weeks)

Unit 1: Biological Building Blocks (5 Weeks)
✓ Cells
✓ DNA and Genetics
✓ Classification
✓ Nutrient Cycles
✓ Ecology

Unit 2: Plants (6 Weeks)
✓ Fungi
✓ Simple Plants
✓ Flowerless Plants
✓ Flowering Plants
✓ Seeds and Fruit
✓ Trees

Animal Units (14 weeks)

Unit 3: Invertebrates (5 Weeks)
✓ Annelids/Platyhelminthes/Nematodes
✓ Cnidarians/Echinoderms
✓ Mollusks
✓ Arthropods
✓ Insects

Unit 4: Vertebrates (5 Weeks)
✓ Fish
✓ Amphibians
✓ Reptiles
✓ Birds
✓ Mammals

Unit 5: Animal Overview (4 weeks)
✓ Science Fair Project
✓ Migration
✓ Animal Behavior
✓ Animal Partnerships
✓ Adaptations and Defenses
**Human Body Unit (10 weeks)**

**Unit 6: Human Body** (10 Weeks)
- ✓ Integumentary System
- ✓ Skeletal System
- ✓ Muscular System
- ✓ Nervous System
- ✓ Endocrine System (optional Reproductive System)
- ✓ Circulatory System
- ✓ Respiratory System
- ✓ Digestive System
- ✓ Urinary System
- ✓ Immune System

**Review (1 week)**
# Materials Listed by Week

## Introductory & Plant Units

### Unit 1: Biological Building Blocks

<table>
<thead>
<tr>
<th>Week</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Microscope, Slides, Cover slips, Onion skin, Celery stalk</td>
</tr>
<tr>
<td>2</td>
<td>Banana Slices, Dish soap, Salt, Ice-cold isopropyl alcohol (70% or higher), Zipper-style plastic bag, Coffee filter, Funnel, Wooden coffee stirrer, Test tube (or clear glass jar)</td>
</tr>
<tr>
<td>3</td>
<td>Leaf for identification</td>
</tr>
<tr>
<td>4</td>
<td>There are no materials needed for this week.</td>
</tr>
<tr>
<td>5</td>
<td>Air dry clay, Shoebox, Paint, Construction paper</td>
</tr>
</tbody>
</table>

### Unit 2: Plants

<table>
<thead>
<tr>
<th>Week</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Bread, Plastic bag, Water</td>
</tr>
<tr>
<td>7</td>
<td>Pond or aquarium water, Small glass jar, Light source, 2 Slides and cover slips</td>
</tr>
<tr>
<td>8</td>
<td>Fern (with spores if possible), Magnifying glass, Microscope, Slide and cover slip</td>
</tr>
<tr>
<td>9</td>
<td>Flower (either lily, poppy or tulip), Razor blade, Magnifying glass, Microscope, Slide and cover slip</td>
</tr>
<tr>
<td>10</td>
<td>2 Cups, Soil, Bean seed, Corn seed, Marker</td>
</tr>
<tr>
<td>11</td>
<td>Ruler, String, Measuring tape, Partner, Broadleaf tree</td>
</tr>
</tbody>
</table>

## Animal Units

### Unit 3: Invertebrates

<table>
<thead>
<tr>
<th>Week</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>Small plastic soda bottle, Sand, Loam, Crushed leaves, Worms, Water, Paper towel, Rubber band</td>
</tr>
<tr>
<td>13</td>
<td>Plastic bowl, Porous material (such as a sponge, brick or charcoal), Liquid bluing, Water, Salt, Measuring spoon</td>
</tr>
<tr>
<td>14</td>
<td>Snail, 2 Lettuce leaves, Paper towel, Caffeinated drink (preferably black coffee), Empty milk jug, Rubber band</td>
</tr>
<tr>
<td>15</td>
<td>3 Cups, 3 Uncooked shrimp shells, Bleach, Vinegar, Salt, Water, Gloves</td>
</tr>
<tr>
<td>16</td>
<td>1 Apple, 2 Glass jars</td>
</tr>
</tbody>
</table>
### Unit 4: Vertebrates

<table>
<thead>
<tr>
<th>Week</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>1 Large clear glass jar or bowl, 3 Small balloons, 3 Small marbles, Ruler, Water</td>
</tr>
<tr>
<td>18</td>
<td>1 Frog dissection kit, 1 Preserved frog</td>
</tr>
<tr>
<td>19</td>
<td>Clothespin, Blindfold, 5 Pieces of bread with different edible spreads on them (such as garlic, cinnamon/ sugar, butter, peanut butter, and plain), 5 Plates</td>
</tr>
<tr>
<td>20</td>
<td>Chopsticks, Tweezers, Pliers, Eye dropper, Sugar, Water, Gummy worms, Peanuts, Seeds, Raisins, Plates</td>
</tr>
<tr>
<td>21</td>
<td>Felt, Cotton balls, Water, 1 Large cup, 4 Small cups, Instant thermometer, Foil</td>
</tr>
</tbody>
</table>

### Unit 5: Animal Overview

<table>
<thead>
<tr>
<th>Week</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>22-25</td>
<td>Science Fair Project supplies will vary depending on the project the students choose to do.</td>
</tr>
</tbody>
</table>

### Human Body Unit

### Unit 6: Human Body

<table>
<thead>
<tr>
<th>Week</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Pennies (10-30), 2 Pieces of hair (at least 5 inches long), Several heavy books, Pencil, Tape, Glass, Bleach, Glove, Water</td>
</tr>
<tr>
<td>27</td>
<td>3 Bones, Vinegar, Glass, 3 Plastic bags, Hammer</td>
</tr>
<tr>
<td>28</td>
<td>Youself, Door frame</td>
</tr>
<tr>
<td>29</td>
<td>Yardstick, Partner</td>
</tr>
<tr>
<td>30</td>
<td>Watch with a second hand, Partner</td>
</tr>
<tr>
<td>31</td>
<td>Water, Cornstarch, Flour, Sugar, Red food coloring, Glass</td>
</tr>
<tr>
<td>32</td>
<td>Watch with a second hand</td>
</tr>
<tr>
<td>33</td>
<td>3 Cups oatmeal (cooked according to package directions and cooled), Water, Bowl, Pantyhose</td>
</tr>
<tr>
<td>34</td>
<td>2 Glasses, Coffee filter, Food coloring, Flour or sand, Water, Rubber band</td>
</tr>
<tr>
<td>35</td>
<td>Several friends, Several different colors of glitter</td>
</tr>
</tbody>
</table>
Unit 2: Plants
Overview of Study

Sequence of Study

- **Week 6:** Fungi
- **Week 7:** Simple Plants
- **Week 8:** Flowerless Plants
- **Week 9:** Flowering Plants
- **Week 10:** Seeds and Fruit
- **Week 11:** Trees

Materials by Week

<table>
<thead>
<tr>
<th>Week</th>
<th>Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Bread, Plastic bag, Water</td>
</tr>
<tr>
<td>7</td>
<td>Pond or aquarium water, Small glass jar, Light source, 2 Slides and cover slips</td>
</tr>
<tr>
<td>8</td>
<td>Fern (with spores if possible), Magnifying glass, Microscope, Slide and cover slip</td>
</tr>
<tr>
<td>9</td>
<td>Flower (either lily, poppy or tulip), Razor blade, Magnifying glass, Microscope, Slide and cover slip</td>
</tr>
<tr>
<td>10</td>
<td>2 Cups, Soil, Bean seed, Corn seed, Marker</td>
</tr>
<tr>
<td>11</td>
<td>Ruler, String, Measuring tape, Partner, Broadleaf tree</td>
</tr>
</tbody>
</table>

Vocabulary for the Unit

1. **Fungi** – Living things that absorb food from living or dead matter around them.
2. **Spore** – A microscopic package of cells produced by a fungus or plant that can grow into a new individual.
3. **Yeast** – A microscopic, single-celled fungus.
4. **Algae** – A simple, plant-like organism that makes its food by photosynthesis.
5. **Hydrophyte** – A plant that is specifically adapted to live in water.
6. **Photosynthesis** – A process that uses light energy to make food from simple chemicals.
7. **Chlorophyll** – The green chemical that gives most plants their color; it traps the sun’s energy so that the plant can use it to make food.
8. **Frond** – The leaf of a fern or palm.
9. **Angiosperm** – A plant that reproduces by bearing flowers, fruit, and seeds.
10. **Pollination** – The transfer of pollen from the male part of a plant’s flower to the female part.
11. **Cotyledon** – A small leaf inside a seed.
12. **Dicot** – A flowering plant that has two cotyledons.
13. **Germination** – The process in which a seed begins to grow when conditions are right.
14. **Monocot** – A flowering plant that has one cotyledon.
15. **Gymnosperm** – A plant that reproduces by naked seeds, such as cones.
16. **Deciduous** – A plant that sheds all its leaves during some part of the year.
17. **Evergreen** – A plant that keeps its leaves throughout the year.

**Memory Work for the Unit**

**Photosynthesis Equation**

\[
\text{Carbon Dioxide} + \text{Water} + \text{Energy from the Sun} \rightarrow \text{Carbohydrates} + \text{Oxygen}
\]

**Parts of a Flowering Plant**

1. **Root** – It helps to anchor the plant and absorb nutrients.
2. **Stem** – It holds the plant up and serves as the transport system for the plant.
3. **Leaf** – It absorbs sunlight and produces energy for the plant through chlorophyll.
4. **Flower** – It is the reproductive part of the plant.
5. **Seed** – It contains the material necessary to grow a new plant.

**Parts of a Flower**

1. Petals
2. Sepals
3. Pistil
4. Stigma
5. Style
6. Ovary
7. Ovules
8. Stamen
9. Anther
10. Pollen
11. Filament

**Notes**
Experiment: Can I grow mold?

Materials
✓ Bread
✓ Plastic bag
✓ Water

Procedure
1. Read the introduction to this experiment and then answer the question.
2. Moisten the bread by sprinkling it with water.
3. Place it in the plastic bag and set the bag in a warm, dark place.
4. Observe the bread every day for five days. Each day, record your observations by taking a picture or by drawing what you see on the experiment sheet.
5. After five days, make your final observations of the bread and finish the experiment sheet.
6. Once you are done, throw the bread away. DO NOT open the plastic bag.

Vocabulary & Memory Work
☐ Vocabulary: fungi, spores, yeast
☐ Memory Work—There is no memory work for this week.

Sketch: Anatomy of a Fungus
☑ Label the following – fruiting body, gills, stalk, mycelium

Writing
kker Reading Assignment: Usborne Science Encyclopedia pp. 284-285 Fungi
kker Additional Research Reading
☑ Fungi: DKEN pp. 114-115
☑ Fungi & Lichens: KSE pg. 55

Dates to Enter
ุม 1588 – Giambattista della Porta first observes fungal spores.
ุม 1836 – English naturalists Miles Joseph Berkeley first used the word mycology to mean the study of fungi.
ุม 1928 – Alexander Fleming discovers penicillin.
## Schedules for Week 6

### Two Days a Week

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Define fungi, spore, and yeast on SG pg. 48</td>
<td>☐ Read pp. 284-285 from the <em>Usborne Science Encyclopedia</em>, then discuss what was read</td>
</tr>
<tr>
<td>☐ Begin the “Can I grow mold?” experiment, then fill out the experiment sheet on SG pp. 52-53</td>
<td>☐ Color and label the “Anatomy of a Fungus” sketch on SG pg. 51</td>
</tr>
<tr>
<td>☐ Enter the dates onto the date sheets on SG pp. 9-12</td>
<td>☐ Prepare an outline or narrative summary; write it on SG pp. 54-55</td>
</tr>
<tr>
<td>☐ Finish the experiment sheet on SG pp. 52-53</td>
<td>☐ Prepare one of the Want More Activities listed OR</td>
</tr>
</tbody>
</table>

**Supplies I Need for the Week**
- ☑ Bread
- ☑ Plastic bag
- ☑ Water

**Things I Need to Prepare**
- *Usborne Science Encyclopedia*
- *Anatomy of a Fungus*
- *Outline or list of facts*
- *Report on SG pg. 55*
- *Additional reading assignments*
- *Report on SG pg. 55*
- *One of the Want More Activities listed OR*
- *Study a scientist from the field of Biology*

### Five Days a Week

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Begin the “Can I grow mold?” experiment, then fill out the experiment sheet on SG pp. 52-53</td>
<td>☐ Read pp. 284-285 from the <em>Usborne Science Encyclopedia</em>, then discuss what was read</td>
<td>☐ Define fungi, spore, and yeast on SG pg. 48</td>
<td>☐ Read one or all of the additional reading assignments</td>
<td>☐ Finish the experiment sheet on SG pp. 52-53</td>
</tr>
<tr>
<td>☐ Enter the dates onto the date sheets on SG pp. 9-12</td>
<td>☐ Color and label the “Anatomy of a Fungus” sketch on SG pg. 51</td>
<td>☐ Prepare a report; write the report on SG pg. 55</td>
<td>☐ Complete one of the Want More Activities listed OR</td>
<td>☐ Study a scientist from the field of Biology</td>
</tr>
</tbody>
</table>

**Supplies I Need for the Week**
- ☑ Bread
- ☑ Plastic bag
- ☑ Water

**Things I Need to Prepare**
Additional Information Week 6

Experiment Information

Introduction – (from the Student Guide) A mold is neither a plant nor an animal. It is part of the Fungi Kingdom and is usually found in dark, damp places. A mold does not contain chlorophyll, so it cannot produce its own food from light like most other plants can. Instead, mold feeds on living or once-living matter. In this experiment, you will see if you can grow mold using a piece of bread.

Results – DO NOT let the students remove their moldy bread from the plastic bag as you could have grown mold that is harmful. The students’ bread should grow mold within three to four days. The students should be able to observe several different types of mold on the bread.

Explanation – Mold spores floating around in the air are trapped in the plastic bag. They land on the bread and begin to take root. The growing mold breaks down the bread to supply its cells with the food they need. (Note—Mold prefers a dark, moist environment to grow in, which is the reason we had to wet the bread a bit.)

Troubleshooting – If you did not observe any mold, this is probably due to the preservatives found in some types of bread. You can have the students redo the experiment with bread that does not contain preservatives or just have them write up their results, noting that the presences of preservatives prevented the mold from growing.

Take it Further – Have the students look at mold in the bag under a microscope and complete the microscope worksheet found on pg. 257 of the Appendix. After you have put on gloves and a protective mask, very carefully open the bag with moldy bread and use a Q-tip to obtain a sample. Then, spread some of it on a slide and add a drop of water. Cover it with a cover slip and have the students look at it under the microscope. DO NOT remove the bread completely from the bag. Be sure to properly discard of the bread and Q-tip once you have the sample.

Discussion Questions

1. What are fungi? (Fungi are simple forms of life. They are neither plants nor animals.)
2. Explain the structure of a fungus. (The main part of a fungus is called the mycelium and it is typically found underground. The mycelium forms a mass of tiny thread-like structures called hyphae. During reproduction, these hyphae pack together to form button-like growths that push through the soil and grow into the fruiting body of the fungus.)
3. What are molds and mildews and where are they found? (Molds and mildews are fungi that do not produce a fruiting body. They are found in warm, damp, and dark places.)
4. Where do fungi get their food? (Fungi get their food by releasing enzymes that break down their food. They then absorb the nutrients they need from the decaying matter.)
5. Are fungi harmful or helpful? Explain why or why not. (Fungi are both harmful and helpful. Harmful fungi can cause skin diseases, as well as mouth and ear infections. Helpful fungi...
are used every day, such as the mold that makes penicillin and yeast that is used in making bread.)

Want More

☞ **Spore Prints** – Have the students make spore prints by following the directions found at:

☞ **Lichens** – Have the students learn more about lichens, which are a partnership between a fungus and an alga or bacterium. You can use the following post as a guide:
   ❯ http://elementalblogging.com/homeschool-science-lichens/

**Sketch Assignment Week 6**

Anatomy of a Fungus

- **Fruiting body**
- **Gills**
- **Stalk**
- **Mycelium**
Experiment: Can I grow algae?

Materials
- Pond or aquarium water
- Small glass jar
- Eye dropper
- Microscope
- 2 Slides and cover slips

Procedure
1. Read the introduction to this experiment and then answer the question.
2. Collect some pond or aquarium water in a small glass jar.
3. Place a drop of water onto a slide and cover it with a cover slip, using the same method you learned in week one.
4. Look at it under the microscope using the 10x objective lens. Move the slide around slowly to see if you can find any green algal cells.
5. Set the jar out on a sunny window sill and observe what happens in the jar over five days.
6. After five days, look at the water under the microscope again using the same procedure you used in steps three and four. Then, complete the experiment sheet.

Vocabulary & Memory Work

- Vocabulary: algae, hydrophyte, photosynthesis
- Memory Work—This week, work on memorizing the photosynthesis equation.
  Carbon Dioxide + Water + Energy from the Sun → Carbohydrates + Oxygen

Sketch: Divisions of Plants

- Read Usborne Science Encyclopedia pg. 295 The Plant Kingdom.
- Label the following: nonvascular plants, vascular plants, plants without seeds, plants with seeds, gymnosperms, angiosperms, monocots, dicots

Writing

- Reading Assignment: Usborne Science Encyclopedia pg. 264 Plant Food (Photosynthesis section), pp. 281-282 Water Plants
- Additional Research Reading
  - Photosynthesis: UIDS pp. 254-255, DKEN pp. 24-25
  - Plant Anatomy: KSE pp. 56-57

Dates to Enter

- 2600 BC- 2000 BC – Ancient Egyptians used different colors of algae as eye makeup.
- 1811-1866 – William Harvey was the first to divide algae into four divisions based on their pigmentation.
# Schedules for Week 7

## Two Days a Week

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>☐ Define algae, hydrophyte, and photosynthesis on SG pg. 48</td>
<td>☐ Read pp. 264, 281-282 from the <em>Usborne Science Encyclopedia</em>, then discuss what was read</td>
</tr>
<tr>
<td>☐ Begin the “Can I grow algae?” experiment, then fill out the experiment sheet on SG pp. 58-59</td>
<td>☐ Prepare an outline or narrative summary; write it on SG pp. 60-61</td>
</tr>
<tr>
<td>☐ Enter the dates onto the date sheets on SG pp. 9-12</td>
<td>☐ Color and label the “Divisions of Plants” sketch on SG pg. 57</td>
</tr>
<tr>
<td>☐ Finish the experiment sheet on SG pp. 58-59</td>
<td>☐</td>
</tr>
</tbody>
</table>
Additional Information Week 7

Experiment Information

Note – If you don’t own a microscope, the students can view algal cells at this website:
http://en.wikipedia.org/wiki/Green_algae
This article has several different pictures of green algae under a microscope.

Introduction – (from the Student Guide) Green algae are the most diverse category of algae. There are over seven thousand different species that grow in many types of aquatic habitats. Green algae have chlorophyll, which captures light energy and uses it to produce sugars for food. In this experiment, you will be attempting to grow green algae from water from a pond or an aquarium.

Results – The students should see their water get a bit greener after five days. The students should also see additional algae cells under the microscope when they examine their water sample.

Explanation – Green algae grow in most freshwater environments. When the samples are placed in a sunny window the algae are able to produce more food because of the additional sunlight. Thus, they are able to reproduce more rapidly and the students are able to see the presence of algae with the naked eye.

Troubleshooting – If the students are unable to grow algae in their glass jars, this may be due to the presence of chlorine or another algicide in the water. You can test for the presence of chlorine using a test kit made for a pool or aquarium, if you desire. You could also try to add a fertilizer, such as liquid plant food, to help encourage algal growth.

Take it Further – Read and research about Red Tide, which is a deadly overgrowth of red algae in the oceans.

Discussion Questions

Plant Food (Photosynthesis section), pg. 264
1. What is an autotrophic plant? (An autotrophic plant is a plant than makes its own food, usually through a process called photosynthesis.)
2. Where does photosynthesis take place? (Photosynthesis takes place in the plant’s leaves in the palisade cells.)
3. What is chlorophyll, where is it, and what does it do? (Chlorophyll is a green pigment found in the chloroplasts. The job of this chemical is to absorb the light from the sun for the energy of photosynthesis.)

Water Plants, pp. 281-282
1. What are the two categories of water plants? Explain a little about each category. (The two categories of water plants are emergent and submergent. Emergent water plants grow well in very wet soil and most of their stems and leaves can be seen above the water surface. Submergent water plants grow mostly underwater, but they may have a few large leaves or flowers floating above water.)
2. Where are algae typically found? (Algae are typically found in water, but they can also grow where conditions are damp.)
3. How are algae different from other plants? (Algae differ from other plants because they
have no roots, leaves, or flowers.) How are they similar? (Algae are similar to other plants because they can make their own food using the Sun’s energy.)

4. What is seaweed? (Seaweed is a multi-cellular type of algae.)

5. What is eutrophication? (Eutrophication is when an abundance of nitrogen in the water causes algae to rapidly reproduce. The algae become so numerous that they use up the oxygen in the water, causing other animals and plants in the water to die.)

Want More

📍 Photosynthesis – Have the students do several activities related to photosynthesis. You can use the following post for ideas:


Sketch Assignment Week 7

Divisions of Plants

- Non-vascular Plants
  - Plants without seeds
    - Gymnosperms
    - Monocots
  - Angiosperms
    - Dicots
- Vascular Plants
  - Plants with seeds
Experiment: Observation of a Fern

Materials
✓ Fern frond (with spores if possible)
✓ Magnifying glass
✓ Microscope
✓ Slide & cover slip

Procedure
1. Read the introduction to this experiment.
2. Observe the fern using your eyes and the magnifying glass, and then answer the questions on the experiment sheet.
3. Make a wet mount slide using the directions from the experiment in week one. Look at the slide using the 40x objective, then draw what you see on the experiment sheet.
4. Draw conclusions and complete the experiment sheet.

Vocabulary & Memory Work
✓ Vocabulary: chlorophyll, frond
✓ Memory Work—Continue to work on the photosynthesis equation.

Sketch: Life Cycle of a Fern
✓ Label the following – The mature plant produces sori, which contain clusters of sporangia. Sporangia release spores into the air. Spores grow into the prothallus, which produces the sex cells. The male and female sex cells fuse. The resulting cell grows into a fern plant.

Writing
✞ Reading Assignment: Usborne Science Encyclopedia pp. 282-283 Flowerless Plants
✞ Additional Research Reading
❑ Non-flowering Plants: KSE pg. 58
❑ Flowerless Plants: DKEN pp. 116-117
❑ Leaves: UIDS pp. 248-250

Dates to Enter
❑ 1855 – Charles Kingsley coins the term Pteridomania or Fern Craze to describe the Victorian era craze of fern collecting and decorating with the fern motif in pottery and glass.
# Schedules for Week 8

## Two Days a Week

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Define chlorophyll and frond on SG pg. 48</td>
<td></td>
</tr>
<tr>
<td>□ Do the “Observation of a Fern” experiment, then fill out the experiment sheet on SG pp. 64-65</td>
<td></td>
</tr>
<tr>
<td>□ Enter the dates onto the date sheets on SG pp. 9-12</td>
<td></td>
</tr>
<tr>
<td>□ Read pp. 282-283 from the <em>Usborne Science Encyclopedia</em>, then discuss what was read</td>
<td></td>
</tr>
<tr>
<td>□ Prepare an outline or narrative summary; write it on SG pp. 66-67</td>
<td></td>
</tr>
<tr>
<td>□ Color and label the “Life cycle of a fern” sketch on SG pg. 63</td>
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</tbody>
</table>

### Supplies I Need for the Week
- Fern (with spores if possible)
- Magnifying glass
- Microscope
- Slide & cover slip

### Things I Need to Prepare

## Five Days a Week

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
<th>Day 4</th>
<th>Day 5</th>
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</thead>
<tbody>
<tr>
<td>□ Do the “Observation of a Fern” experiment, then fill out the experiment sheet on SG pp. 64-65</td>
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<tr>
<td>□ Read pp. 282-283 from the <em>Usborne Science Encyclopedia</em>, then discuss what was read</td>
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<tr>
<td>□ Define chlorophyll and frond on SG pg. 48</td>
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<tr>
<td>□ Enter the dates onto the date sheets on SG pp. 9-12</td>
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<tr>
<td>□ Color and label the “Life cycle of a fern” sketch on SG pg. 63</td>
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<tr>
<td>□ Read one or all of the additional reading assignments</td>
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<tr>
<td>□ Prepare a report; write the report on SG pg. 67</td>
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<td>□ Complete one of the Additional Activities listed</td>
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<tr>
<td>□ Study a scientist from the field of Biology</td>
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</tbody>
</table>

### Supplies I Need for the Week
- Fern (with spores if possible)
- Magnifying glass
- Microscope
- Slide & cover slip

### Things I Need to Prepare
Additional Information Week 8

Notes

☀ Sketch – The sketch for this week is slightly different from that the picture in the book. You may have to help the students label it this week.

Experiment Information

☞ Note – If you don’t have a microscope, have the students view the following YouTube video from Martin Microscope about fern spores:

http://www.youtube.com/user/MartinMicroscope#p/a/u/1/5hGQcmM6njY

☞ Introduction – (from the Student Guide) Ferns are primitive plants that are generally found in humid forests and near river banks. Ferns do not flower. They also release spores instead of seeds. In this experiment, you will examine and observe the structure of a fern.

☞ Results – The students should make some observations about a fern. They should be able to see layers of plant cells when they look at the fern under the microscope.

☞ Explanation – The goal of this experiment was to get the students to practice their observation skills. If they were able to draw the fern and the plant cells they saw, they have accomplished the purpose of this experiment.

☞ Take it Further – Have the students make a fern identification book. Go on a nature walk in the woods to see what types of ferns the students can find. Have the students take samples and press the fronds so that they can make a fern identification book.

Discussion Questions

1. What is asexual reproduction? (Asexual reproduction is a type of reproduction in which only one parent is needed to produce offspring, which are identical to itself.)

2. How do liverworts and mosses get the water they need to survive? (Liverworts and mosses absorb the water though their leaf-like structures.)

3. Where are ferns found? (Ferns are found all over the world in damp, shady places.)

4. Describe how a fern grows. (A fern grows when leaves, called fronds, push out of the earth. They are tightly coiled and as the plant grows, the fronds unfurl.)

5. What does “alternation of generations” mean? (Alternation of generations is a two-stage reproductive cycle used by most flowerless plants. The first stage is sexual and a sporophyte is produced. The second stage is asexual and spores are produced.)

6. How do ferns reproduce? (Ferns reproduce by using spores.)

Want More

☞ Moss Graffiti – Have the students collect a bit of the moss to make some natural graffiti.

You will need a chunk of moss, yogurt, water, sugar, a blender, a brick or porous stone, and a paintbrush. Soak the brick or porous stone in water overnight. The next day, in a blender, mix 1 cup of yogurt, 1 cup of water, and 1/4 teaspoon of sugar. Mix thoroughly. Then, break the chunk of moss into small pieces and add them to the blender. Mix until smooth and chunk-free. Now, have the students use the mixture to paint a design on the brick or stone. Place the brick or stone in a place that receives a moderate amount of light and watch the students’
designs grow. (Note—You may need to water the moss designs daily if they are in a place that does not have a lot of moisture.)

Sketch Assignment Week 8

Life Cycle of a Fern

The mature plant produces sori, which contain clusters of sporangia.

The sporangia release spores into the air.

The spores grow into the prothallus, which produces the sex cells.

The male and female sex cells fuse.

The resulting cell grows into a fern plant.
Vocabulary Matching

1. Fungi ___
   A. A microscopic, single-celled fungus.
2. Spore ___
   B. The process in which a seed begins to grow when conditions are right.
3. Yeast ___
   C. A plant that is specifically adapted to live in water.
4. Algae ___
   D. Living things that absorb food from living or dead matter around them.
5. Hydrophyte ___
   E. A flowering plant that has one cotyledon.
6. Photosynthesis ___
   F. A simple, plant-like organism that makes its food by photosynthesis.
7. Chlorophyll ___
   G. The transfer of pollen from the male part of a plant’s flower to the female part.
8. Frond ___
   H. The green chemical that gives most plants their color; it traps the sun’s energy so that the plant can use it to make food.
9. Angiosperm ___
   I. A plant that keeps its leaves throughout the year.
10. Pollination ___
    J. A microscopic package of cells produced by a fungus or plant that can grow into a new individual.
11. Cotyledon ___
    K. A small leaf inside a seed.
12. Dicot ___
    L. A plant that sheds all its leaves during some part of the year.
13. Germination ___
    M. The leaf of a fern or palm.
14. Monocot ___
    N. A plant that reproduces by bearing flowers, fruit, and seeds.
15. Gymnosperm ___
    O. A plant that reproduces by making cones.
16. Deciduous ___
    P. A flowering plant that has two cotyledons.
17. Evergreen ___
    Q. A process that uses light energy to make food from simple chemicals.
True or False

1. _______ Fungi are part of the animal kingdom.

2. _______ Molds and mildews are fungi which do not produce a fruiting body.

3. _______ Algae can only be found in the ocean.

4. _______ Photosynthesis is the process by which plants turn carbon dioxide, water, and energy from sunlight into carbohydrates for food and oxygen.

5. _______ Ferns reproduce by using seeds.

6. _______ Alternation of generations is a single stage reproductive cycle used by most flowering plants.

7. _______ A self-pollinating plant is able to pollinate itself.

8. _______ The sepals are small leaf-like petals that protect the bud as it develops.

9. _______ Fruit forms in the stamen of a flower.

10. _______ The tulip and the orchid are monocotyledons because they have only one seed leaf.

11. _______ When deciduous trees lose their leaves in the fall, the chlorophyll remains in the leaf that is shed from the tree.

12. _______ Trees have a waxy substance in their inner wood, or xylem, which stiffens the trunk and provides the tree with greater stability.

Short Answer

1. How do fungi get their food?
2. How are algae similar to other plants?

How are algae different from other plants?

3. How does a fern grow?

4. Name three of the parts of a plant and tell what they do.
5. Briefly describe plant fertilization.

6. What does a seed need to germinate?

7. What is the main difference between deciduous and evergreen trees?
Vocabulary Matching

6. Q

True or False

1. False (Fungi are not a part of the plant or animal kingdom; instead, they have their own kingdom.) 7. True
2. True 8. True
3. False (Algae can be found in the water and on suitably damp soil and rock.) 9. False (Fruit forms from the ovary of the flower.)
4. True 10. True
5. False (Ferns reproduce using spores.) 11. False (The chlorophyll leaves the leaf of a deciduous tree before it is shed.)
6. False (Alternation of generations is a two-stage reproductive cycle used by most flowerless plants.) 12. True

Short Answer

1. They release enzymes that decompose living and dead organisms, and then they absorb the nutrients.
2. Algae are similar to other plants because they have chlorophyll and they make their own food by photosynthesis. Algae differ from other plants because they have no roots, leaves, or flowers.
3. A fern grows by forming small buds at the base of the plant on the stem. These buds then mature and unroll. Finally, the leaflets unroll and grow to maturity quickly.
4. Possible answers include:
   - Root – It helps to anchor the plant and absorb nutrients.
   - Stem – It holds the plant up and serves as the transport system for the plant.
   - Leaf – It absorbs sunlight and produces energy for the plant through chlorophyll.
   - Flower – It is the reproductive part of the plant.
   - Seed – It contains the material necessary to grow a new plant.
5. Plant fertilization begins when pollen from a flower lands on the stigma of the same species of plant. Then, the pollen sprouts a tube down to the ovule, where the male and female sex
cells meet and fertilization occurs.

6. Seeds need the right amount of warmth, oxygen, and water to germinate.

7. Deciduous trees shed their leaves at certain times in the year, while evergreens keep their leaves all year long.