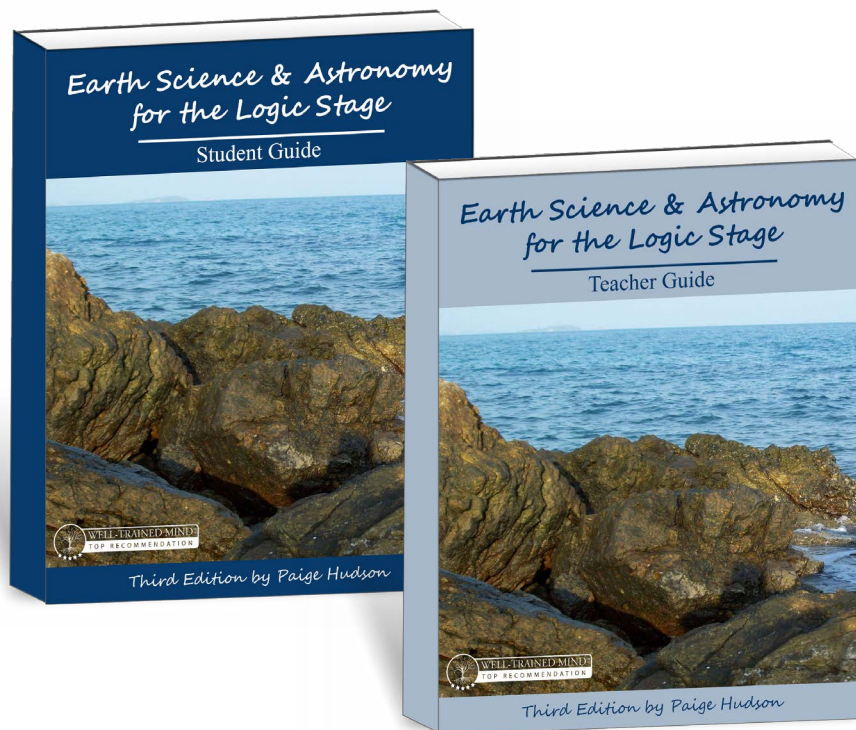




Earth Science & Astronomy for the Logic Stage {3rd Edition} Sample Packet

The following sample packet includes the first two weeks of the third edition of *Earth Science & Astronomy for the Logic Stage* materials. You will see:

- ✓ The Teacher Guide (*beginning on pg. 3*)
- ✓ The Student Guide (*beginning on pg. 38*)

You can get more information and purchase this award-winning program here:

🔗 <https://elementalscience.com/collections/earth-science-astronomy-for-the-logic-stage>

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*Earth Science
& Astronomy
for the
Logic Stage*

Teacher Guide

A Peek Inside the Logic Stage Teacher Guide

The teacher guide is your go-to resource for guiding your students through science!

1. Weekly Topic

Explore one main topic throughout the week. The students will learn about the subject by doing experiments, reading from visually appealing encyclopedias, and writing what they have learned. You can assign them optional activities as well.

2. Two Scheduling Options

Provide guidance to the students with these two grid-style scheduling options. There are 2-day-a-week and 5-day-a-week schedules. These schedules break down the essential work and the optional activities into manageable chunks so that you can help them proceed with confidence.

3. Student Assignment Sheet

See the core of our logic stage programs—the student assignment sheets. In the teacher guide, you will find snippets of this sheet so that you have a clear picture of the tasks that have been assigned to the students for the week.

4. Notes

Get key information and further explanations of the topics when necessary. These notes will assist you as you teach science to your students.

DO Science

5. Experiment Information

Know what you need to know about the weekly experiment, which will coordinate with the topic. This section includes the

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Week 1: Universe **1**

2-Days-a-Week Schedule

	Day 1	Day 2
Do	☐ Do the "Can I calculate the speed of light?" experiment	☐ {Choose one of the Want More Activities}
Read	☐ Define universe ☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read ☐ {Work on the Types of Stars Memory Work}
Write	☐ Fill out the experiment sheet ☐ Enter the dates onto the date sheets	☐ Color and label the "Contents of the Universe" sketch ☐ Prepare an outline or narrative summary

2

5-Days-a-Week Schedule

	Day 1	Day 2	Day 3	Day 4	Day 5
Do	☐ Do the "Can I calculate the speed of light?" experiment		☐ {Choose one of the Want More Activities}		☐ {Choose one of the Want More Activities}
Read	☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read	☐ Define universe	☐ {Read one or all of the additional reading assignments}	☐ {Work on the Types of Stars Memory Work}
Write	☐ Fill out the experiment sheet	☐ Write an outline or list of facts	☐ Color and label the "Contents of the Universe" sketch	☐ {Prepare a report}	☐ Enter the dates onto the date sheets

Supplies I Need for the Week

- ✓ Large chocolate bar, Large plate, Microwave, Ruler
- ✓ {Optional} Telescope, Night Sky Field Guide, Journal

Astronomy Unit 1: Space ~ Week 1: Universe

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Teacher Notes

Student Assignment Sheet Week 1

Do - Hands-on Science Activities

- ☐ **Experiment:** Can I calculate the speed of light using a microwave?

Materials

- ✓ Large chocolate bar, Large plate, Microwave, Ruler

(Note—Melted chocolate is very hot and can burn. Please use caution.)

- ☐ **Want More Activities:** See your teacher for additional information about observing the universe.

Experiment Information

Introduction—(in the student materials) The universe is the vast expanse of space in which all things are found. It contains us, our planet, our solar system, our galaxy and at least 100 billion galaxies. Astronomers have studied what they call the observable universe since the first telescope in 1609. As astronomers began to record their observations, they found the need to calculate distances, so that they could give approximate locations for the objects in the universe. Since the distances in the universe are so large, astronomers began to use light years to calculate them. A light year is the distance a wavelength of light will travel in one year, or about 5.88 trillion miles. In this experiment, you are going to try to calculate the speed of light, which scientists then multiply by the time in one year to calculate a light year.

Procedure

1. Unwrap the chocolate bar and place it on the plate. Remove the turntable from your microwave and set the plate inside.
2. Begin by heating the chocolate bar for 1 minute; check to see if it has begun to melt. (You are looking to see if there are two spots that have begun to melt. You DO NOT want the entire chocolate bar to melt.) If the bar has not begun to melt, continue to heat it for 30-second intervals, checking each time to see if melting has begun.
3. Once melting has begun, carefully remove the plate from the microwave and measure the distance between the centers of the two melted points.
4. Record the distance on your experiment sheet and complete the calculations.

Results—Depending on the strength of your microwave, the students will measure the distance between the two spots to be between five to ten centimeters. Here is a sample calculation for a student that measured a 6 centimeters (0.06 meters) distance in a 2450 Mega Hertz (MHz) microwave.

Calculation #1: $0.06 \text{ m} \times 2 = 0.12 \text{ m}$ (wavelength)

Calculation #2: $2450 \text{ MHz} \times 1,000,000 = 2,450,000,000 \text{ Hz}$ (cycles per second)

Calculation #3: $0.12 \text{ m} \times 2,450,000,000 \text{ Hz} = 294,000,000 \text{ m/s}$ (close to the speed of light)

When the students complete the calculations, they should see that their results are close to the

Astronomy Unit 1: Space ~ Week 1: Universe

introduction and procedure, which are also included in the student materials. It also lists the expected results, an explanation, and ideas to take the hands-on science fun further.

6. Want More Activities

Add a bit of fun with these optional research projects and hands-on science project ideas. These relate to and reinforce what the students are learning about the week's subject.

READ Science

7. Discussion Questions with Answers

Find discussion questions with the answers. You have the tools necessary to lead an effective discussion time without having to read the selection.

8. Vocabulary

Enhance your students' science vocabulary by introducing words that are relevant to the weekly topic.

WRITE Science

9. Sketch Answers

Know how and where the students should label the pre-drawn sketches with the completed images.

10. Unit Tests

Test what your students have learned over the unit with the end-of-unit tests. These are only in the teacher guide, so you can choose to use them orally, written, or not at all.

Student Assignment Sheet Week 1
Read - Gathering Information

☐ **Main Reading Assignment:** *Kingfisher Science Encyclopedia* p.386-387 (The Universe)

Optional Research Readings

1a Big Bang Theory: *K&E* p.388-389

1b The Universe: *USE* p.154-155

☐ **Vocabulary:** universe

☐ **Memory Work:** This week, work on memorizing the Types of Stars.

1. Big giant - A large, hot star off the main sequence.
2. Red giant - An older star with a cooler outer layer.
3. Neutron star - The tightly packed collapsed core of a larger star.
4. Main-sequence star - A star plotted in the left-to-right band across the HR diagram.
5. Black hole - A gravitationally dense region of space-time where nothing can escape, not even light.
6. White dwarf - A stellar core remnant of a low to medium mass star.
7. Red dwarf - A cool, small star on the main sequence.

Informational Notes

If you want to introduce your students to the Big Bang theory, this is the week to do so. The pages for this week are scheduled as an additional resource reading assignment, which gives you the opportunity to introduce the theory or not. I want to encourage you to do so, even if you don't hold to the Big Bang theory. It is often referred to as the most plausible explanation for the origin of the universe, and it is important that students are familiar with what it says. It is also equally as important that as teachers/parents, we share with our students what we hold to be true about the origins of the universe. I believe that logic stage is a good time to begin having those discussions. If you decide to include these pages, here are some discussion questions for you to use.

1. Explain the Big Bang theory. (Many astronomers believe that there was a huge explosion that created a large amount of energy. This energy was then transformed into subatomic particles, which after 500,000 years, turned into a soup of elements. After a billion years, gravity pulled the elements into clouds, which then formed the first galaxies and stars.)
2. What evidence do astronomers use to support the Big Bang theory? (Astronomers use the fact that galaxies are moving farther apart to support the Big Bang theory. They use this fact because it suggests that the galaxies were once concentrated in a single place.)
3. What evidence for the Big Bang still eludes scientists? (Scientists still haven't found the majority of the universe's matter or the stuff that the universe is composed of.)
4. What do many cosmologists believe will happen to our universe? (Many cosmologists believe that our universe will expand to a certain point and then it will begin to contract. Eventually it will collapse inward and implode in an event they call the Big Crunch. This will destroy everything, but it will be followed by another Big Bang.)

Astronomy Unit 1: Space ~ Week 1: Universe

Questions to help you and your students as you examine the material.

1. (The word *theory* comes from the ancient Greek word *theoria*, meaning "observing" or "contemplating". In science, a theory is an analytical tool used for making predictions about a certain subject matter. Theories are developed through observation and experimentation to determine if they are fact.)

2. (The word *fact* is a statement that is verifiable through observation. Facts can be proven through experimentation.)

3. (The Big Bang came from the first law of thermodynamics: Energy can neither be created nor destroyed. The first law of thermodynamics states: Energy can only change forms. Therefore the energy for the Big Bang came from the Big Bang itself. If the Big Bang is true, where did the original energy for it come from? To this question, it's something that scientists are still trying to answer. Some reasons that the Big Bang theory remains a theory instead of a fact are that it cannot be proven through experimentation.)

Reading Assignments

1. (We can see other galaxies by using a telescope.) How many do you know about approximately 100 billion galaxies that can be seen from Earth.)

2. How do astronomers measure distances in the universe? (Within our solar system, astronomers use the Astronomical Unit (AU) to measure objects. The AU is equal to the distance between the Earth and the Sun, which is about 93 million miles. Outside of our solar system, astronomers use light years to measure objects in the universe. A light year is the distance that light travels in one year, which is about 5.88 trillion miles.)

3. What does everything in the universe do? (Everything in the universe moves.)

Vocabulary

☐ **Universe** - The collection of all matter, space, and energy that exists, also known as the cosmos.

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Student Assignment Sheet Week 1
Write - Notebooking Assignments

☐ **Writing Assignments:** Write a list of facts, an outline, or a report.

☐ **Sketch:** Contents of the Universe

➤ Label the following: Earth, Our Solar System, Milky Way Galaxy, Cluster of Galaxies, The Universe

Astronomy Unit 1: Space ~ Week 1: Universe

Dates to Enter

- 1929 - Edwin Hubble proves that the universe is expanding.
- 1965 - Scientists find heat waves in the universe that they believe are leftover from a vast explosion.
- 1992 - The satellite *Cosmic Background Explorer* traces background radiation and ripples in the universe that are thought to be leftover from the Big Bang.

Sketch Assignment Answers

Astronomy Unit 1: Space ~ Week 1: Universe

Astronomy Unit 1: Space
Unit Test

- A group of galaxies that are found close together.
- The collection of all the matter, space, and energy that exists, also known as the cosmos.
- The twelve constellations through which the sun, moon, and planets appear to move.
- A massive, hot, shining ball of gas.
- A body held together by gravity that is made of millions of stars, gas, and dust.
- The pattern that a group of stars seems to make in the sky.
- Formed by a collapsed star, has a very strong gravitational pull.
- The largest structure composed of many galaxy clusters.
- Clouds of dust and gas from which stars are born.

1. _____ Astronomers know of less than 2 million galaxies in our universe.

2. _____ Everything in our universe moves.

3. _____ The galaxy that our solar system is found on is called the Milky Way galaxy.

4. _____ Galaxies are classified according to their size.

5. _____ A star produces heat and light energy, as well as UV radiation and X-rays.

Astronomy Unit 1: Space ~ Unit Test

A Peek Inside the Logic Stage Student Guide

Harness the benefits of notebooking, and promote independent learning with the student guide.

1. Student Assignment Sheet

See the core of our logic stage programs—the student assignment sheets. This sheet has all the assignments for the week with checkboxes for the student to use.

2. Pre-drawn Sketch

Color the pre-drawn sketch relating to the week's topic. Then have the students label it with the information on the Student Assignment Sheet.

3. Experiment Sheet

Do an experiment related to the topic for the week. The Experiment Sheet contains the introduction and the procedure for the experiment. It also has space for the students to record the hypothesis, materials, observation, results, and conclusion.

4. Written Assignment

Know the questions for discussion time, and have plenty of space for the students to write either a list of facts, an outline, or summary.

5. Unit Glossary

Keep all the unit vocabulary in one place. The glossary gives space for the students to write the definitions for each vocabulary word.

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Student Assignment Sheet Astronomy Week 1
Universe

Do - Hands-on Science Activities

☐ **Experiment:** Can I calculate the speed of light using a microwave?

Materials

✓ Large chocolate bar, Large plate, Microwave, Ruler
(Note—Melting chocolate is very hot and can burn. Please use caution.)

☐ **Want More Activities?** See your teacher for additional information about observing the universe.

Read - Gathering Information

☐ **Main Reading Assignment:** *Universe for Science Encyclopedia* p. 386-387 (The Universe)

☐ **Optional Research Reading:**

□□ Big Bang Theory: KQED
□□ The Universe: *USE* p. 154-155

☐ **Vocabulary:** universe

☐ **Memory Work:** This week, work on memorizing the Types of Stars.

1. **Blue giant** - A large, hot star off the main sequence.
2. **Red giant** - An older star with a cooler outer layer.
3. **Neutron star** - The tightly packed collapsed core of a larger star.
4. **Main sequence star** - A star plotted in the left to right band across the HR diagram.
5. **Black hole** - A gravitationally dense region of space-time where nothing can escape, not even light.
6. **White dwarf** - A stellar core remnant of a low to medium mass star.
7. **Red dwarf** - A cool, small star on the main sequence.

Write - Notebooking Assignments

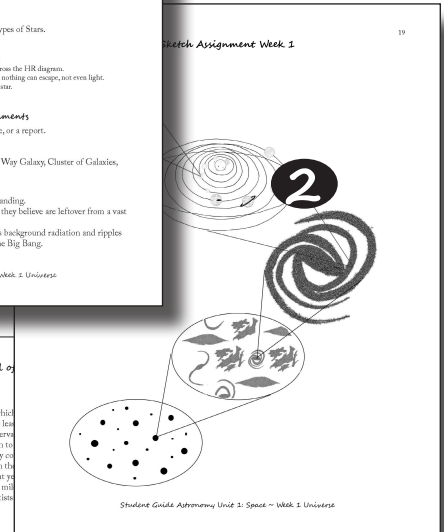
☐ **Writing Assignments:** Write a list of facts, an outline, or a report.

☐ **Sketch:** Contents of the Universe
→ Label the following: Earth, Our Solar System, Milky Way Galaxy, Cluster of Galaxies, The Universe.

☐ **Dates to Enter**

- 1929 - Edwin Hubble proves that the universe is expanding.
- 1965 - Scientists find heat waves in the universe that they believe are leftover from a vast explosion.
- 1992 - The satellite *Cosmic Background Explorer* traces background radiation and ripples in the universe that are thought to be leftover from the Big Bang.

Student Guide Astronomy Unit 2: Space ~ Week 1: Universe



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Experiment: Can I calculate the speed of light using a microwave?

Introduction

The universe is the vast expanse of space in which us, our planet, our solar system, our galaxy and all the Astronomers have studied what they call the observable universe. The first telescope in 1609. As astronomers began to find the need to calculate distances, so that they could see the objects in the universe. Since the distances in the universe are so large, it takes a long time for light to travel in one year, or about 5.88 trillion miles to try to calculate the speed of light, which scientists use to calculate a light year.

Hypothesis

Can I calculate the speed of light using a microwave? Yes No

Materials

3

Procedure

1. Unwrap the chocolate bar and place it on the plate. Remove the turntable from your microwave and set the plate inside.
2. Begin by heating the chocolate bar for 1 minute; check to see if it has begun to melt. (You are looking to see if there are two spots that have begun to melt. You **DO NOT** want the entire chocolate bar to melt.) If the bar has not begun to melt, continue to heat it for 30-second intervals, checking each time to see if melting has begun.
3. Once melting has begun, carefully remove the plate from the microwave and measure the

CAUTION
Melted chocolate is very hot and can burn. **DO NOT touch!**

Student Guide Astronomy Unit 2: Space ~ Week 1: Universe

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Written Assignment Week 1

Discuss the following questions in the universe? Write down your thoughts.

4

Student Guide Astronomy Unit 2: Space ~ Week 1: Universe

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Unit Glossary

Define the following terms as they are assigned on your Student Assignment Sheet.

1. Universe -
2. Galaxy -
3. Cluster -
4. Supercluster -
5. Star -
6. Nebulae -
7. Black hole -
8. Constellation -

Student Guide Astronomy Unit 2: Space ~ Vocabulary

In a Nutshell

Students will study space, the solar system, astronomers, our planet, geology, and meteorology in the following ways:

- ✓ Doing **hands-on science** through experiments and activities.
- ✓ Reading **scientific information** from visually appealing encyclopedias.
- ✓ Writing down what they have learned and seen using **organized notebooking**.

See p. 21 for a list of the topics explored in this program.

What You Need

Besides this guide, you will need:

1. **The student materials**—You will need to purchase the *Earth Science & Astronomy for the Logic Stage Student Guide*. Get a glimpse of the student guide (SG) on p. 9.

2. **The two required spines:**

 *The Usborne Science Encyclopedia (Usborne, 2015 Edition)*

 *The Kingfisher Science Encyclopedia (Kingfisher, 2024 Edition)*

You can also purchase one or more of the optional research encyclopedias, which you can see listed in the introduction. Get links to these books here:

 <https://elementalscience.com/blogs/resources/esals>

3. **The experiment supplies**—See a full list starting on p. 23 or save yourself the time and purchase the *Earth Science & Astronomy for the Logic Stage Experiment Kit*.

How It Works

Each week, you and your middle school student will:

🌀 **Do** the weekly experiments by following the procedure, recording your observations and results, and drawing conclusions about what you saw.

🌀 **Read** the assigned pages and discuss the information with you using the included questions.

🌀 **Write** down what the students have learned in a way that is appropriate for their skills and label a related sketch.

You can also add in the memory work and additional science activities if you want to dig deeper into a topic. For a more detailed explanation of the components in each lesson, we highly recommend checking out the peek inside this program on pp. 7-8 and reading the introduction starting on pp. 10-15, or seeing how to structure your week on pp. 16-19. Otherwise, the first lesson begins on p. 28.

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Introduction to the Third Edition

It has been more than 13 years since the first edition of *Earth Science & Astronomy for the Logic Stage* was released. With each edition, the format has been refined, but the method has always been based on the same three keys to teaching science:

1. Read about science.
2. Do, or rather play with, science.
3. Write about science.

In this guide are the tools you need to teach science using the Classic Method found in *Success in Science: A Manual for Excellence in Science Education*, where 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.” 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.

Earth Science & Astronomy 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.

The Student Guide

Earth Science & Astronomy for the Logic Stage seeks to encourage independence in the students as they learn about the field of earth science and astronomy. To do this, we have created a student guide which is sold separately.

The *Earth Science & Astronomy for the Logic Stage 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 and all the sheets they will need for the science fair project. In short, the student guide contains all the pages the students will need in a bound book. This guide is essential to complete this program.

Now that you understand that, let’s take a closer look at what you will find in your teacher guide.

The Teacher Guide

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 to use as you guide the students through *Earth Science & Astronomy for the Logic Stage*.

Weekly Schedule Options

Earth Science & Astronomy for the Logic Stage should 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, there are two scheduling options to use as you lead them through this program. These are guides, so feel free to change the order to better fit the needs of the students.

We also recommend that you let the students be in charge of choosing how many days they would like to do science because this will help foster independence in their schoolwork. You will find two blank scheduling templates for you to use in the appendix of this guide on pp. 243–244.

Do—Hands-on Science Activities

Experiments

Each week will revolve around a weekly topic. 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 p. 237 for a brief explanation of the scientific method).

The shaded box contains the hands-on science information from the student assignment sheet. After that, you will find several sections for the experiments:

- ☐ Introduction and Procedure—Both sections are copies of what can be found in the student materials. (*If needed, you find troubleshooting tips in this section, too.*)
- ☐ Results—This section shares the expected results.
- ☐ Explanation—This section provides an explanation of the expected results.
- ☐ Take It Further—This section has ideas you can use to expand on the experiment.

The Science Fair Project

A science fair project is scheduled for the students during Unit 5. *Janice VanCleave's A+ Science Fair Projects* and *Janice VanCleave's A+ Projects in Earth Science: Winning Experiments for Science Fairs and Extra Credit* are excellent resources for choosing project topics within the field of earth science or astronomy. If you would like the students to take part in a science fair, you can call your local school system to see if it allows homeschooled students to take part, or you can get information on national science fairs from them. Otherwise, the students can present their projects in front of a group of friends and family.

{Optional} Want More Activities

Each week, the “Do” section includes a list of additional activities. ***These activities are totally optional.*** The “Want More” activities explore the science on a deeper level by researching specific topics or through additional projects. The students do not have this information in their guides, so it is up to you whether to assign these. Several of the “Want More” activities may 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:

1. **Home Science Tools** (<http://www.hometrainingtools.com>)

2. **Nasco Science Supplies** (<http://www.enasco.com/science>)
3. **Carolina Biological Supply Company** (<http://www.carolina.com>)

Read—Gathering Information

Main Reading 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.

We have included a list of possible discussion questions from the main reading assignment along with the answers. These are meant to aid you in leading the discussion time with the students. You should encourage them to answer in complete sentences because this will help them organize their thoughts for the writing assignment.

The discussion questions are also in the student materials, so the students can be prepared. However, if they are already writing outlines or lists of facts, you do not need to have them write out the answers. There is plenty of writing required in this program already.

Vocabulary

Throughout the year, the students will be assigned weekly vocabulary. They will need to write out the definitions for each word on the Unit Vocabulary Sheet found in the student guide during 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.

Memory Work

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.

Write—Notebooking Assignments

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 sixth grader completing this program should be expected to write a two-level outline for the pages assigned for the week. This outline should include the main point from each paragraph on the page along with one to three supporting points.
- ❑ **Option 2: Have the students write a narrative summary from the spine text**—A typical sixth grader completing this program should be expected to write a two- to four-paragraph summary (or six to ten sentences) 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 level outline or list of seven to nine facts for the two page spread. Next have the students do some additional reading on the topic from one or more of the additional research assignments. Each topic will have pages assigned from these reference books listed below for their research.

- 📖 *The Usborne Science Encyclopedia, 2015 Edition* (USE)—This resource is appropriate for most fifth and sixth graders. It is also used as a spine text for 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 used as a spine text for this study.
- 📖 *The DK Encyclopedia of Science, 2016 Edition* (DKEOS)—This resource is a slightly more advanced reference work than the *Kingfisher Science Encyclopedia*.
- 📖 *DK Eyewitness Books: Astronomy, 2013 Edition* (DK Astro)—This resource is only for the astronomy study and also approaches the high school level.
- 📖 *Exploring the Night Sky, 1987 Edition* (ENS)—This is more of a stargazing guide, but several pages are scheduled throughout the astronomy unit.

Once the students complete the additional research reading, have them write a report of two to four paragraphs detailing what they have learned from their research reading.

Keep in mind that 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.

Sketch

Each week, the students will be assigned a sketch to complete and label. The student materials contain 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.

Dates to Enter

Each week, the dates of important discoveries within the topic 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 in the appendix of this guide, on pp. 232-235.

Unit Tests

The students will complete a lot of work each week that will help you assess what they are learning, so testing is not absolutely necessary. However, we have included end-of-unit tests you can use with the students if you feel the need to do so. The tests and their answers are included after the material for each unit in this guide. You can choose to give the tests orally or copy them for the students to fill out.

Additional Information

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 on our blog, podcast, and YouTube channel.

As you prepare to guide your students through this program, you may find the following articles helpful:

- 🔊 *The 3 Keys to Teaching Science*—This video explains how we believe science should be taught.
 <https://youtu.be/yOVbBNENkOU>
- 🔊 *Classical Science Curriculum for the Logic Stage Student*—This podcast details the goals of logic stage science and shows how the classical educator can use the tools they have at their disposal to reach these goals.
 <https://elementalscience.com/blogs/podcast/114>
- 🔊 *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>
- 🔊 *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.
 <https://elementalscience.com/blogs/news/simple-explanation-of-the-scientific-method/>

Safety Advisory

Some experiments in this book use either boiling water or open flames. We recommend 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.

Additional Resources

You will find quick links to the web-based activities suggested in this guide, along with several helpful downloads, at the following website:

 <https://elementalscience.com/blogs/resources/esals>

A Quick Note from the Author

If you find 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 questions or problems that you might have concerning *Earth Science & Astronomy 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 *Earth Science & Astronomy for the Logic Stage*!

~ Paige Hudson

How to Structure Your Week

Two Days a Week

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 the first week 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 “Can I calculate the speed of light using a microwave?” experiment. Have them read the introduction and then perform the experiment using the directions provided. Next have them complete the necessary calculations, discuss their results with you and then write a conclusion for their experiment. Finish the day by having them look up and define “universe” 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. 386–387 in the *Kingfisher 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 two level outline of the spine text for Week 1

- I. The universe consists of everything in space.
 - A. The universe contains atoms, people, our Earth, our solar system and countless galaxies.
 - B. We cannot see everything that is included in the universe.
- II. Measuring distances in the universe is different than measuring distances on Earth.
 - A. We use Astronomical Units to measure distances within our solar system.
 - B. We use light years to measure distances in the universe outside of our solar system.
- III. Everything in the universe is moving.
 - A. Planets spin on their axis and orbit the Sun.
 - B. Galaxies in the universe move with the expansion of the universe.

Sample Narrative Summary from the spine text only for Week 1

The universe is a dynamic entity that consists of everything in existence. It contains the smallest particles, like atoms as well as countless stars and galaxies. Our planet and solar system are all a part of the universe. It is so large that we cannot see everything that is included in the universe.

Astronomers cannot use the same unit to measure distances in the universe that they use on Earth. On Earth we use either the metric or the US Customary system to measure distances. However

distances in the universe are too great to use meters or feet to measure. Instead astronomers use Astronomical Units to measure distances within our solar system and light years to measure distances in the rest of the universe.

The universe is always changing because it is constantly moving. The planets in our solar system are moving by spinning on their axis. The stars and other objects in our galaxy are moving by orbiting around a central point in the Milky Way. Then there are other galaxies that are moving with the expansion of the universe. Finally, the universe itself is continually expanding.

Five Days a Week

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 the first week as an example:

✦ **Day 1: *Do the experiment, and complete the experiment sheet.***

Begin Day 1 by having the students do the “Can I calculate the speed of light using a microwave?” experiment. Have them read the introduction and then perform the experiment using the directions provided. Next have them complete the necessary calculations, 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. 386-387 in the *Kingfisher Science Encyclopedia*. Then using the questions provided, discuss what they have read. Then have the students write a two level outline or a list of facts. Here’s a sample list of facts:

Sample list of facts from the spine text for Week 1

1. *The universe contains atoms, people, our Earth, our solar system and countless galaxies.*
2. *We cannot see everything that is included in the universe.*
3. *We use Astronomical Units to measure distances within our solar system.*
4. *We use light years to measure distances in the universe outside of our solar system.*
5. *Everything in the universe is moving.*
6. *Planets spin on their axis and orbit the Sun.*
7. *Galaxies in the universe move with the expansion of the universe.*

✦ **Day 3: *Record the dates, define the vocabulary, and complete the sketch.***

Have the students look up and define “universe” using the glossary in their guide and adding 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. 154-155 in the *The Usborne Science Encyclopedia*. Then have the students use their outline or list facts along with what they have just read to write a three- to five-paragraph summary of what they have learned. Here’s a sample

of what that summary could look like:

Sample Written Report for Week 1

The universe is the term used to describe all the atoms, people, planets, galaxies, and space that exists. It is large that we can't see most of the universe. Scientists use light years to measure distances in the portions of the universe that we can see. A light year is distance that light can travel within one year.

The universe is always changing because it is constantly moving. The planets in our solar system are moving by spinning on their axis. The stars and other objects in our galaxy are moving by orbiting around a central point in the Milky Way. Then there are other galaxies that are moving with the expansion of the universe. Finally, the universe itself is continually expanding.

The constant expansion of the universe and a weak signal from deep space have led scientist to create the Big Bang theory as an explanation of how the universe began. The Big Bang Theory states that a big bang created a huge fireball, which cooled and formed into tiny particles, called matter. This matter then spread out forming thick clouds of hydrogen and helium. Over time, these clouds separated and formed the galaxies and planets we know today.

✦ **Day 5: Complete one of the "Want More" activities.**

Have the students spend some time observing the universe or use this day to discuss the Big Bang Theory.

How to Include Younger Students

We 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 Earth Science & Astronomy for the Grammar Stage.**

This option if the younger students are in first through third grade and/or the older student is ready for some independence. You will need to rearrange the units in *Earth Science & Astronomy for the Logic Stage* so that all the students will remain on similar topics. If you choose to do this, have the older student complete Unit 4 through Unit 6, Unit 2, Unit 3, and finish with Unit 1.

✦ **Option 2: Have the younger students use Earth Science & Astronomy for the Logic Stage along with the older students.**

This option if the younger students are in third through fourth grade and/or the older students are not ready to work independently. You will need to adjust the work load 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 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 read to them out of the *Usborne Science Encyclopedia*, which is scheduled as an additional research reading resource or you can use the following books instead:

 *DK First Space Encyclopedia, 2016 Edition*

 *DK First Earth Encyclopedia, 2010 Edition*

A chart coordinating these resources in the appendix of this guide on pp. 238-240.

Book List

The following books were used when planning this study. Get links for these on the program resource page found here:

 <https://elementalscience.com/blogs/resources/bls>

Encyclopedias for Reading Assignments

The following books are the main spines of this program. You will need to purchase both 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, 2024 Edition* (USE)

 *The Kingfisher Science Encyclopedia, 2024 Edition* (KSE)

{Optional} References for Reports

The following encyclopedias are scheduled for additional reference reading. They are optional.

 *The DK Encyclopedia of Science, 2016 Edition* (DKEOS)—This resource is a slightly more advanced reference work than the *Kingfisher Science Encyclopedia*.

 *DK Eyewitness Books: Astronomy, 2013 Edition* (DK Astro)—This resource is only for the astronomy study and also approaches the high school level.

 *Exploring the Night Sky, 1987 Edition* (ENS)—This is more of a stargazing guide, but several pages are scheduled throughout the astronomy unit.

{Optional} Experiment Equipment

If you would like to create a more lab-like experience for the students this year, you can use 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.

Sequence of Study

Astronomy Units (15 weeks)

Unit 1: Space (5 weeks)

- ✓ Universe
- ✓ Galaxies
- ✓ Stars
- ✓ Constellations
- ✓ Constellations: Research Project

Unit 2: Our Solar System (6 Weeks)

- ✓ Sun
- ✓ Inner Planets
- ✓ Earth/Moon
- ✓ Outer Planets
- ✓ Dwarf Planets
- ✓ Comets, Meteorites

Unit 3: Astronomers & Their Tools (4 Weeks)

- ✓ Astronomers
- ✓ Looking into Space
- ✓ Exploring Space
- ✓ Satellites

Earth Science Units (20 weeks)

Unit 4: Our Planet (7 weeks)

- ✓ Inside the Earth
- ✓ Maps and Mapping
- ✓ Rivers
- ✓ Oceans
- ✓ Glaciers
- ✓ Natural Cycles
- ✓ Biomes and Habitats

Unit 5: Geology (7 weeks)

- ✓ Continents
- ✓ Volcanoes
- ✓ Earthquakes

- ✓ Mountains
- ✓ Rocks
- ✓ Ores and Gems
- ✓ Erosion and Weathering

Unit 6: Weather (6 Weeks)

- ✓ Atmosphere
- ✓ Climates
- ✓ Weather
- ✓ Clouds
- ✓ Extreme Weather
- ✓ Forecasting

Review (1 week)

Materials Listed by Week

Astronomy Units

Unit 1: Space

<i>Week</i>	<i>Materials</i>
1	Large chocolate bar, large plate, microwave
2	4 Types of Galaxies article (in appendix of SG), galaxy cards
3	Aluminum foil, large piece of cardboard (large enough to fit under the glass bowl), glass bowl, flashlight, scissors
4	Shoebox, black construction paper, pin, flashlight
5	Shoebox planetarium from previous week, black construction paper, pin & a flashlight

Unit 2: Our Solar System

<i>Week</i>	<i>Materials</i>
6	2 glass jars or 2 clear glasses, Plastic wrap, 2 Black tea bags, Water, Instant read thermometer
7	3 Heavy duty plastic bottles, 3 Balloons, 3 tsp of yeast (1 ½ packages), 3 TBSP of sugar, Water, White vinegar
8	Apple, Fork, Flashlight, Partner
9	Wooden Dowel, Foil, Paper clip, Toaster
10	Construction paper, Paints or crayons
11	Marble, Rubber bouncy ball, Foam ball, Tennis ball, Cake pan, Cornstarch, Ruler

Unit 3: Astronomers & Their Tools

<i>Week</i>	<i>Materials</i>
12-14	Materials will vary depending on the Science Fair Project that your student has chosen to do

Earth Science Units

Unit 4: Our Planet

<i>Week</i>	<i>Materials</i>
16	Permanent marker, 1 Raw egg, 1 Hard-boiled egg
17	Blue balloon (with the continents drawn or printed on it), Flat map, Pin
18	Pitcher for water, Water, Cookie sheet, Paper cup, Straw, Dirt or sand, Small rocks, Clay or play dough, Books, Tape

Unit 4: Our Planet (continued)

Week	Materials
19	Aluminum bread pan or Plastic bin, Air dry clay, Water, Sand (1 cup), 2 Straws
20	Glacier Melt Model (make using cup, water, pebbles, sand), Large cutting board with a handle, Large rubber band
21	Cup, Baggie, Water, Rubber band
22	Paper towels, Wax paper, Rubber band, Water

Unit 5: Geology

Week	Materials
23	Marshmallow creme (or whipping cream), Graham crackers, 3 Plates, Bowl with water
24	Mentos™, Cardboard cereal box, 1-Liter bottle of cola (or orange soda), 1 Can of Great Stuff™ Foam, Paints, Aluminum oil
25	Partner, Slinky, Rope
26	Several different colors of crayons, Grater, Butter knife, Pencil sharpener, Foil, Bowl, Warm water, Foil muffin cups
27	7 to 10 Rocks collected from outside, Rock & Mineral field guide, Plastic baggie, Sharpie Marker, White-out
28	5 to 8 More rocks collected from outside, Rock & Mineral field guide, Foam board, Sharpie Marker, White-out
29	Dirt or sand, Grass seed, Water, Pitcher, 2 Aluminum pans Note — <i>You will need to plant your grass seed mountain at least 7 days before doing this experiment so that it will grow in time to do the experiment.</i>

Unit 6: Weather

Week	Materials
30	3 Cups, 2 Colors of food coloring, Hot and cold water
31	3 Foil muffin cups, Soil from outside, Sand, Water , Desk lamp
32	Balloon, Two permanent markers of different colors, A partner
33	2 Liter bottle, Water, Matches
34	Large clear round container, Warm water , Red food coloring, Blue ice cubes
35	Battery powered toothbrush, Sound recording device

Astronomy *Unit 1*

Space

Astronomy Unit 1: Space Overview of Study

Books Scheduled

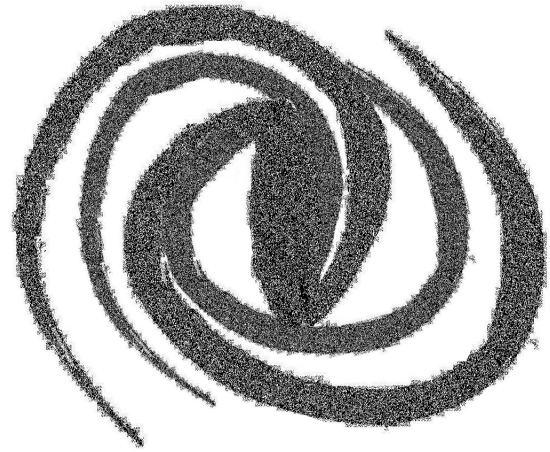
- 📖 *The Usborne Science Encyclopedia* (USE)
- 📖 *The Kingfisher Science Encyclopedia* (KSE)

{Optional Encyclopedias}

- 📖 *DK Eyewitness Books: Astronomy, 2013 Edition* (DK Astro)

Sequence of Study

- 📅 **Week 1:** Universe
- 📅 **Week 2:** Galaxies
- 📅 **Week 3:** Stars
- 📅 **Week 4:** The Big and Little Dipper
- 📅 **Week 5:** Constellations



Memory Work for the Unit

Types of Stars

1. Blue giant – A large, hot star off the main sequence.
2. Red giant – An older star with a cooler outer layer.
3. Neutron star – The tightly-packed collapsed core of a larger star.
4. Main-sequence star – A star plotted in the left-to-right band across the HR diagram.
5. Black hole – A gravitationally dense region of space-time where nothing can escape, not even light.
6. White dwarf – A stellar core remnant of a low to medium mass star.
7. Red dwarf – A cool, small star on the main sequence.

Constellations of the Zodiac

1. Aquarius
2. Aries
3. Cancer
4. Capricorn
5. Gemini
6. Leo
7. Libra
8. Pisces
9. Sagittarius
10. Scorpio
11. Taurus
12. Virgo

Materials by Week

Week	Materials
1	Large chocolate bar, large plate, microwave
2	4 Types of Galaxies article (in appendix of SG), galaxy cards
3	Aluminum foil, large piece of cardboard (large enough to fit under the glass bowl), glass bowl, flashlight, scissors
4	Shoebox, black construction paper, pin, flashlight
5	Shoebox planetarium from previous week, black construction paper, pin & a flashlight

Vocabulary for the Unit

1. **Universe** – The collection of all the matter, space, and energy that exists, also known as the cosmos.
2. **Galaxy** – A body held together by gravity that is made of millions of stars, gas, and dust.
3. **Cluster** – A group of galaxies that are found close together.
4. **Supercluster** – The largest structure in the universe, composed of many galaxy clusters.
5. **Star** – A massive, hot, shining ball of gas.
6. **Nebulae** – Clouds of dust and gas found in space.
7. **Black hole** – Formed by a collapsed star, has a very strong gravitational pull.
8. **Constellation** – The pattern that a group of stars seems to make in the sky.
9. **Planetarium** – A device used to project images of the stars or depict the solar system.
10. **Zodiac** – The twelve constellations through which the sun, moon, and planets appear to move.

Week 1: Universe

2-Days-a-Week Schedule

	Day 1	Day 2
Do	☐ Do the “Can I calculate the speed of light?” experiment	☐ {Choose one of the Want More Activities}
Read	☐ Define universe ☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read ☐ {Work on the Types of Stars Memory Work}
Write	☐ Fill out the experiment sheet ☐ Enter the dates onto the date sheets	☐ Color and label the “Contents of the Universe” sketch ☐ Prepare an outline or narrative summary

5-Days-a-Week Schedule

	Day 1	Day 2	Day 3	Day 4	Day 5
Do	☐ Do the “Can I calculate the speed of light?” experiment		☐ {Choose one of the Want More Activities}		☐ {Choose one of the Want More Activities}
Read	☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read	☐ Define universe	☐ {Read one or all of the additional reading assignments}	☐ {Work on the Types of Stars Memory Work}
Write	☐ Fill out the experiment sheet	☐ Write an outline or list of facts	☐ Color and label the “Contents of the Universe” sketch	☐ {Prepare a report}	☐ Enter the dates onto the date sheets

Supplies I Need for the Week

- ✓ Large chocolate bar, Large plate, Microwave, Ruler
- ✓ {Optional} Telescope, Night Sky Field Guide, Journal

Teacher Notes

Student Assignment Sheet Week 1 (SG p. 18)

Do—Hands-on Science Activities

- ☐ **Experiment:** Can I calculate the speed of light using a microwave? (SG pp. 20-21)

Materials

- ✓ Large chocolate bar, Large plate, Microwave, Ruler

(**Note**—*Melted chocolate is very hot and can burn. Please use caution.*)

- ☐ **Want More Activities:** See your teacher for additional information about observing the universe.

Experiment Information

☞ **Introduction** – (*in the student materials*) The universe is the vast expanse of space in which all things are found. It contains us, our planet, our solar system, our galaxy and at least 100 billion other galaxies. Astronomers have studied what they call the observable universe since Galileo invented the first telescope in 1609. As astronomers began to record their observations, they found the need to calculate distances, so that they could give approximate locations for the objects in the universe. Since the distances in the universe are so large, astronomers began to use light years to calculate them. A light year is the distance a wavelength of light will travel in one year, or about 5.88 trillion miles. In this experiment, you are going to try to calculate the speed of light, which scientists then multiply by the time in one year to calculate a light year.

☞ **Procedure** – (*in the student materials*)

1. Unwrap the chocolate bar and place it on the plate. Remove the turntable from your microwave and set the plate inside.
2. Begin by heating the chocolate bar for 1 minute; check to see if it has begun to melt. (**Note**—*You are looking to see if there are two spots that have begun to melt. You DO NOT want the entire chocolate bar to melt.*) If the bar has not begun to melt, continue to heat it for 30-second intervals, checking each time to see if melting has begun.
3. Once melting has begun, carefully remove the plate from the microwave and measure the distance between the centers of the two melted points.
4. Record the distance on your experiment sheet and complete the calculations.

☞ **Results** – Depending on the strength of your microwave, the students will measure the distance between the two spots to be between five to ten centimeters. Here is a sample calculation for a student that measured a 6 centimeters (0.06 meters) distance in a 2450 Mega Hertz (MHz) microwave.

Calculation #1: $0.06 \text{ m} \times 2 = 0.12 \text{ m}$ (wavelength)

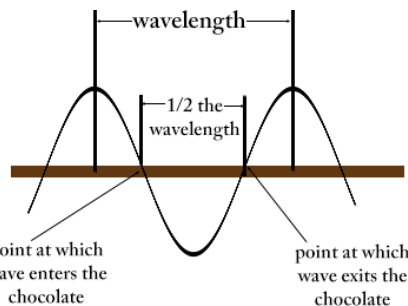
Calculation #2: $2450 \text{ MHz} \times 1,000,000 = 2,450,000,000 \text{ Hz}$ (cycles per second)

Calculation #3: $0.12 \text{ m} \times 2,450,000,000 \text{ Hz} = 294,000,000 \text{ m/s}$ (close to the speed of light)

When the students complete the calculations, they should see that their speed is close to the

actual speed of light (299, 792, 452 m/s).

- ☞ **Explanation** – Microwave ovens have an electromagnetic wave that has the same frequency and wavelength as light. In a microwave, the energy, or heat, is concentrated at the peaks of the waves. So the chocolate will melt first at the points where the wavelength entered and exited the chocolate bar (*see diagram*). If you measure the distance between the centers of the two melted spots, you are measuring the distance between two nodes of a standing wave, which is half of the wavelength. You then multiple that times 2, to get the full wavelength. Then multiple the wavelength by the frequency or number of hertz, or cycles per second (which you can find on the back of your microwave). This will give you the speed in meters per second, which should be close to the speed of light.



- ☞ **Troubleshooting** – This is a challenging experiment for middle schoolers. In case you don't get the right results, here are a few troubleshooting tips.

- ❖ *You only saw one melted hole in the center of your chocolate bar.*

Solution – Be sure your chocolate bar is at least 12 cm long and make sure that your plate is not spinning. You may need to remove both the plate and the spinner from your microwave before doing this experiment.

- ❖ *Your answer is way off from the speed of light.*

Solution – Units! In this experiment we used several units of measurement that are common in science, but may not be familiar to the students. I have included a chart explaining each of the units for your reference.

Unit Abbreviation	What it stands for	What it's used for
cm	Centimeters	Measurement of length 100 cm = 1 m
m	Meters	
MHz	Mega Hertz	Frequency or cycles per second, 1MHz = 1,000,000 Hz
Hz	Hertz	
m/s	Meters per Second	Measurement of speed

- ❖ *If you are still having problems, the following video will give you a good visual reference of this experiment.*

📺 <https://www.youtube.com/watch?v=kpB1wezpjE>

Want More Activities

- 📖 **Observe the Universe** – There are many things about our universe that can be observed from Earth by the naked eye or by using a telescope. Take some time this week to record what you can observe. Go outside at night, take pictures of what you see and use a field guide to identify what you have observed (*Exploring the Night Sky* or *Usborne Discovery Astronomy* are two good options.) Have the students create a mini-book or journal detailing what they have seen. You can add to this project as you continue to work your way through the astronomy units.

Read—Gathering Information

- ❑ **Main Reading Assignment:** *Kingfisher Science Encyclopedia* p. 386-387 (The Universe)

Optional Research Readings

📖 Big Bang Theory: *KSE* p. 388-389

📖 The Universe: *USE* p. 154-155

- ❑ **Vocabulary:** universe (SG p. 16)

- ❑ **Memory Work:** This week, work on memorizing the Types of Stars. (SG p. 245)

1. Blue giant – A large, hot star off the main sequence.
2. Red giant – An older star with a cooler outer layer.
3. Neutron star – The tightly-packed collapsed core of a larger star.
4. Main-sequence star – A star plotted in the left-to-right band across the HR diagram.
5. Black hole – A gravitationally dense region of space-time where nothing can escape, not even light.
6. White dwarf – A stellar core remnant of a low to medium mass star.
7. Red dwarf – A cool, small star on the main sequence.

Informational Notes

If you want to introduce your students to the Big Bang theory, this is the week to do so. The pages for this are scheduled as an additional resource reading assignment, which gives you the option to assign them or not. I want to encourage you to do so, even if you don't hold to the Big Bang theory as the truth of how the universe began. In today's world, most astronomers do believe in the Big Bang theory. It is often referred to as the most plausible explanation for the origins of the universe, so it is important that students are familiar with what it says. It is also equally as important that as teachers/parents, we share with our students what we hold to be true about the origins of the universe. I believe that logic stage is a good time to begin having those discussions. If you do decide to include these pages, here are some discussion questions for you to use.

1. Explain the Big Bang theory. (*Many astronomers believe that there was a huge explosion that created a large amount of energy. This energy was then transformed into subatomic particles, which after 300,000 years, turned into a soup of elements. After a billion years, gravity pulled the elements into clouds, which then formed the first galaxies and stars.*)
2. What evidence do astronomers use to support the Big Bang theory? (*Astronomers use the fact that galaxies are moving farther apart to support the Big Bang theory. They use this fact because it suggests that the galaxies were once concentrated in a single place.*)
3. What evidence for the Big Bang still eludes scientists? (*Scientists still haven't found the majority of the universe's matter or the stuff that the universe is composed of.*)
4. What do many cosmologists believe will happen to our universe? (*Many cosmologists believe that our universe will expand to a certain point and then it will begin to contract. Eventually it will collapse inward and implode in an event they call the Big Crunch. This will destroy everything, but it will be followed by another Big Bang.*)

I have also included a couple of questions to help you and your students as you examine the Big Bang Theory in your homeschool.

1. Theory vs. Fact

- ☛ In science, what is a theory? (*The word theory comes from the ancient Greek word theoria, which means “a looking at, viewing or beholding”. In science, a theory is an analytical tool used for understanding, explaining or making predictions about a certain subject matter. Theories are meant to be tested by experimentation and observation to determine if they are fact.*)
- ☛ In science, what is fact? (*The word fact is comes from the Latin word factum, which means “a thing done or performed”. In science, a fact is an objective and verifiable observation. Facts can be verifiable through repeatable experimentation.*)

2. Origins

- ☛ Where did the energy for the Big Bang come from? (*We know from the first law of thermodynamics that energy is conserved. The first law of thermodynamics states: Energy can be neither created nor destroyed. It can only change forms. Therefore the energy for the Big Bang had to come from somewhere. If the Big Bang is true, where did the original energy for it come from? There’s no real answer to this question, it’s something that scientists are still trying to figure out and one of the main reasons that the Big Bang theory remains a theory instead of fact.*)

Discussion Questions for Reading Assignments

1. How can we see other galaxies? (*We can see other galaxies by using a telescope.*) How many do we know about? (*Astronomers know about approximately 100 billion galaxies that can be seen from Earth.*)
2. How do astronomers measure distances in the universe? (*Within our solar system, astronomers use the Astronomical Unit (AU) to measure objects. The AU is equal to the distance between the Earth and the Sun, which is about 93 million miles. Outside of our solar system, astronomers use light years to measure objects in the universe. A light year is the distance that light travels in one year, which is about 5.88 trillion miles.*)
3. What does everything in the universe do? (*Everything in the universe moves.*)

Vocabulary

- ☐ **Universe** – The collection of all the matter, space, and energy that exists, also known as the cosmos.

Write—Notebooking Assignments

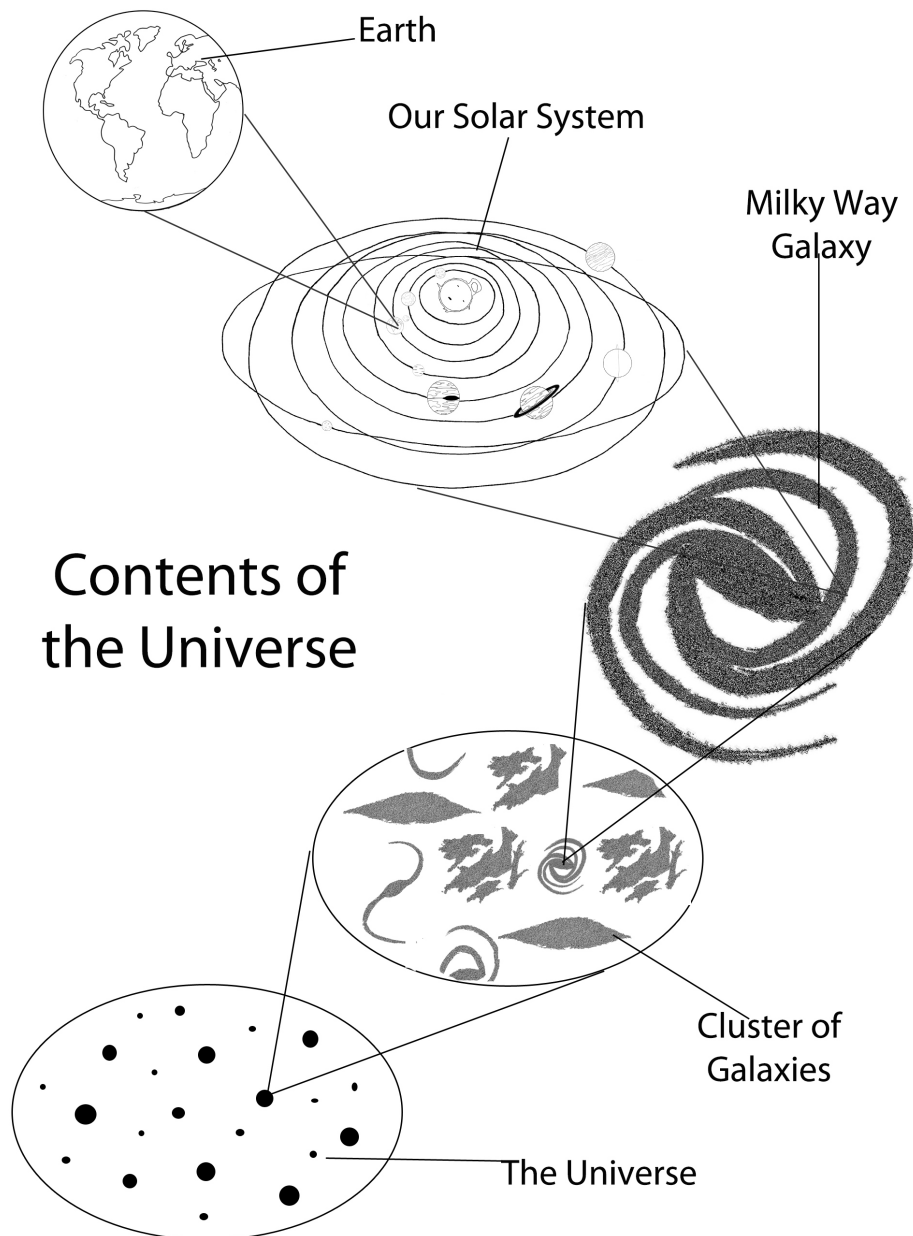
- ☐ **Writing Assignments:** Write a list of facts, an outline, or a report. (SG pp. 22-23)
- ☐ **Sketch:** Contents of the Universe (SG p. 19)
 - ☞ Label the following: Earth, Our Solar System, Milky Way Galaxy, Cluster of Galaxies, The Universe

Write—Notebooking Assignments (continued)

☐ Dates to Enter (SG pp. 11-14)

- ⌚ 1929 – Edwin Hubble proves that the universe is expanding.
- ⌚ 1965 – Scientists find heat waves in the universe that they believe are leftover from a vast explosion.
- ⌚ 1992 – The satellite *Cosmic Background Explorer* traces background radiation and ripples in the universe that are thought to be leftover from the Big Bang.

Sketch Assignment Answers



Week 2: Galaxies

2-Days-a-Week Schedule

	Day 1	Day 2
Do	☐ Do the “Identifying Galaxies” experiment	☐ {Choose one of the Want More Activities}
Read	☐ Define galaxy, cluster, and supercluster ☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read ☐ {Work on the Types of Stars Memory Work}
Write	☐ Fill out the experiment sheet ☐ Enter the dates onto the date sheets	☐ Color and label the “4 Types of Galaxies” sketch ☐ Prepare an outline or narrative summary

5-Days-a-Week Schedule

	Day 1	Day 2	Day 3	Day 4	Day 5
Do	☐ Do the “Identifying Galaxies” experiment		☐ {Choose one of the Want More Activities}		☐ {Choose one of the Want More Activities}
Read	☐ {Read one or all of the additional reading assignments}	☐ Read the reading assignment and discuss what was read	☐ Define galaxy, cluster, and supercluster	☐ {Read one or all of the additional reading assignments}	☐ {Work on the Types of Stars Memory Work}
Write	☐ Fill out the experiment sheet	☐ Write an outline or list of facts	☐ Color and label the “4 Types of Galaxies” sketch	☐ {Prepare a report}	☐ Enter the dates onto the date sheets

Supplies I Need for the Week

- ✓ Galaxy Information Sheet, Galaxy Trading Cards
- ✓ {Optional} White paper, Round plastic containers, Pencils, Scissors, Colored chalk pastel, Black paper, Glitter tempera paints (white included)

Teacher Notes

Student Assignment Sheet Week 2 (SG p. 24)

Do – Hands-on Science Activities

- ☐ **Experiment:** Identifying Galaxies (SG pp. 26-27)

Materials

- ✓ Galaxy cards (Your instructor will provide these cards.)

- ☐ **Want More Activities:** See your teacher for games you can play with the galaxy cards and a deep space art project.

Experiment Information

- ☞ **Introduction** – (*in the student materials*) All galaxies are massive celestial bodies made up of stars, gas and dust. They are held together by gravity and classified by their shape. There are four main types of galaxy shapes, spiral, elliptical, barred spiral, and irregular. In this experiment, you are going to read more about each type of galaxy shape and then identify several galaxies using what you have learned.

- ☞ **Procedure** – (*in the student materials*)

1. Read “Four Types of Galaxies” found on SG p. 248 of the Appendix.
2. Fill in the Galaxy Information Chart on your experiment sheet with the information.
(**Note**—*The galaxy cards can be found in the appendix of this guide on pp. 245–248. Simply print them out, fold them in half and glue them together.*)
3. Next, look at each of the galaxy cards, determine which type of galaxy they are by using the information included.
4. Then check your answers with your teacher.

- ☞ **Results** – The students’ charts should look like this:

Type of Galaxy	Spiral	Elliptical	Barred Spiral	Irregular
Shape	pinwheel shaped	round or oval shape	pinwheel shaped with a bar of stars, dust and gas running across the center	no regular shape
Bulge & Disks	bulge and thin disk present	bulge, but no disk	bulge and thin disk present	may show signs of a disk and a halo
Gas & Dust	rich in gas and dust	little cool gas and dust	rich in gas and dust	usually rich in gas and dust
Types of Stars	young and old stars are present	mainly old stars are present	young and old stars are present	young and old stars are present

Examples (from Galaxy Cards)	NGC 7217 Messier 100 Andromeda	NGC 4881 NGC 3377	NGC 4156 Milky Way	NGC 5253
--	--------------------------------------	----------------------	-----------------------	----------

Want More Activities

- 📄 **Galaxy Cards** – Print out an extra set of galaxy cards and use them to play games like Go Fish or Memory. You could also have the students match the information to the galaxy for more of a challenge.
- 📄 **Deep Space Art** – Have the students make a chalk drawing of the planets and the galaxy. Directions can be found at the following website:
 <https://www.deepspacesparkle.com/planets-and-galaxy-project-for-fifth/>

Read—Gathering Information

- ❑ **Main Reading Assignment:** *Kingfisher Science Encyclopedia* p. 390-391 Galaxies

Optional Research Readings

-  Galaxies: *USE* p. 156-157
-  Our Galaxy and Beyond: *DK Astro* p. 62-63
- ❑ **Vocabulary:** galaxy, cluster, supercluster (SG p. 16)
- ❑ **Memory Work:** This week, continue to work on memorizing the Types of Stars. (SG p. 245)

Discussion Questions for Reading Assignments

1. What is the name of the galaxy our solar system is in? (*Our solar system is found in the Milky Way Galaxy.*)
2. How are galaxies classified? (*Galaxies are classified according to their shape.*)
3. What are two things that astronomers believe help to determine the shape of a galaxy? (*Astronomers believe that the amount of material, the speed of spin and the rate at which stars form all help to determine the shape of a galaxy.*)
4. Describe the typical active galaxy. (*The typical active galaxy has a luminous core that emits huge jets of material. The center also has a glowing ring of gas and dust that surrounds a black hole.*)
5. Which cluster of galaxies does the Milky Way belong to? (*The Milky Way belongs to the Local Group cluster of galaxies.*)

Vocabulary

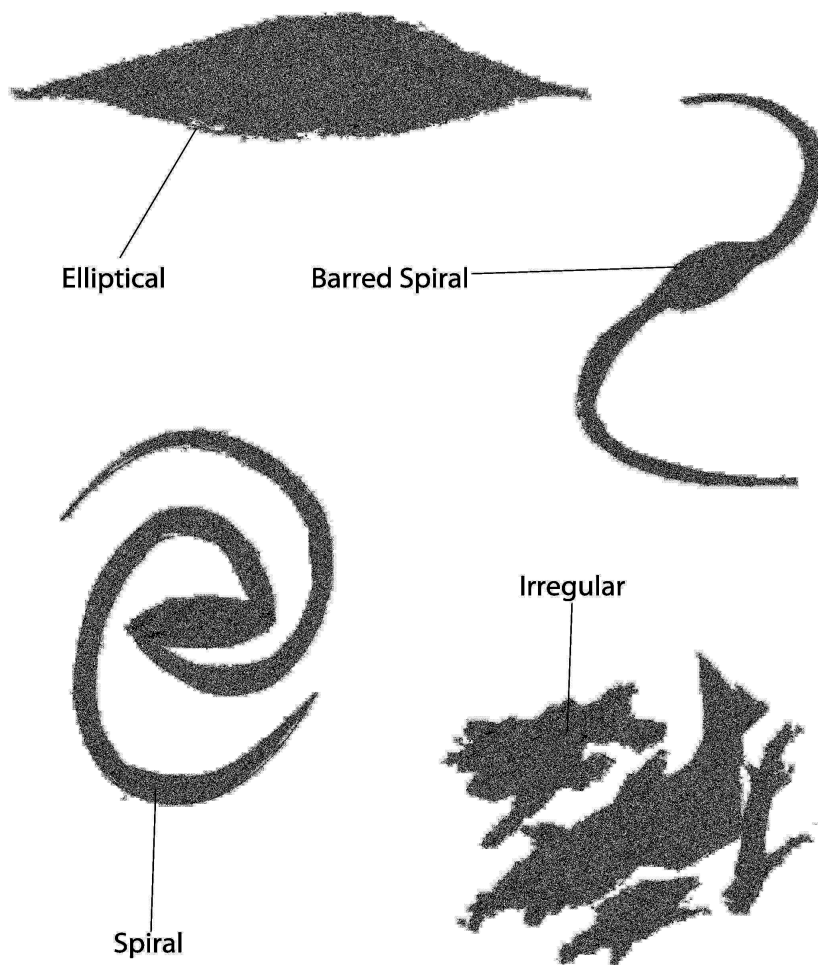
- ❑ **Galaxy** – A body held together by gravity that is made of millions of stars, gas, and dust.
- ❑ **Cluster** – A group of galaxies that are found close together.
- ❑ **Supercluster** – The largest structure in the universe, composed of many galaxy clusters.

Write—Notebooking Assignments

- ❑ **Writing Assignments:** Write a list of facts, an outline, or a report. (SG pp. 28-29)
- ❑ **Sketch:** 4 Types of Galaxies (SG p. 25)
 - ✎ Label the following: irregular galaxy, elliptical galaxy, spiral galaxy and barred spiral galaxy
- ❑ **Dates to Enter** (SG pp. 11-14)
 - ⌚ 1784 – Charles Messier finds several blurry objects that he records as nebulae. These are later discovered to be galaxies.
 - ⌚ 1845 – Lord Rosse draws the galaxy M51, without knowing what it is.
 - ⌚ 1924 – Edwin Hubble presents the first evidence of other galaxies.

Sketch Assignment Answers

4 Main Types of Galaxies



*Earth Science
& Astronomy
for the
Logic Stage*

Student Guide

A Peek Inside the Logic Stage Student Guide

Harness the benefits of notebooking and promote independent learning with the student guide.

1. Student Assignment Sheet

See the core of our logic stage programs—the student assignment sheets. This sheet has all the assignments for the week, with checkboxes to use.

2. Pre-drawn Sketch

Color the pre-drawn sketch relating to the week's topic. Then, label it with the information given on the Student Assignment Sheet.

3. Experiment Sheet

Do an experiment related to the topic for the week. The Experiment Sheet contains the introduction and the procedure for the experiment. It also has space to record the hypothesis, materials, observation, results, and conclusion.

4. Written Assignment

Know the questions for discussion time, and have plenty of space to write either a list of facts, an outline, or summary.

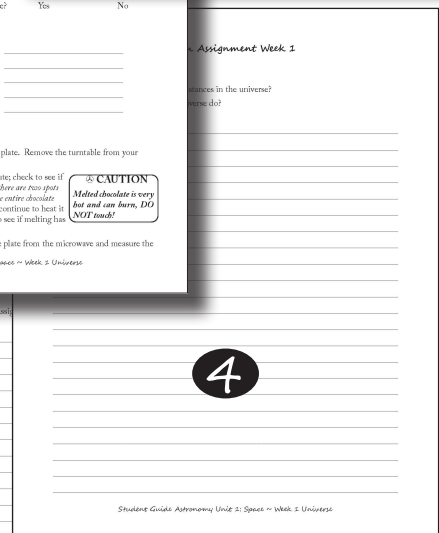
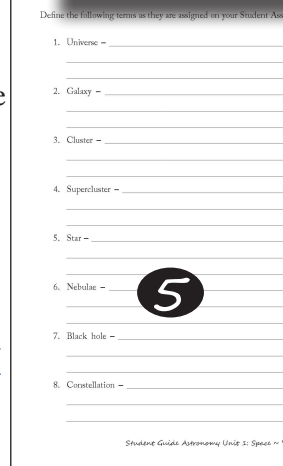
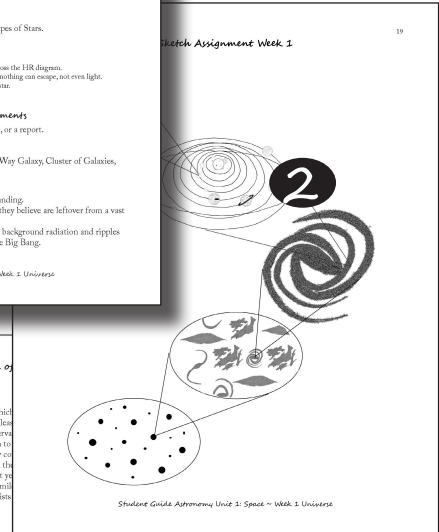
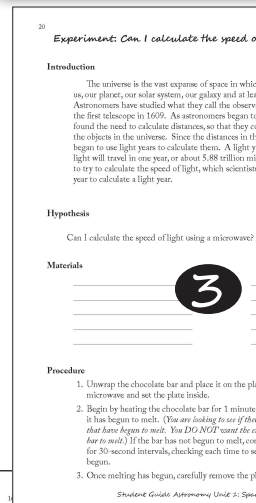
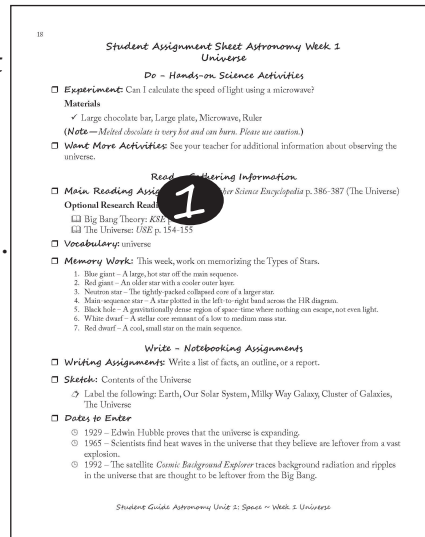
5. Unit Glossary

Keep all the unit vocabulary in one place. The glossary gives space to write the definitions for each the vocabulary word.

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/esals>



Classical SCIENCE

A Quick Welcome from the Author

Dear Student,

Welcome to your journey through earth science and astronomy, which is the study of our planet and space. This year, you will examine the various features of our planet and our universe. You will look at rocks, weather, and the solar system along your voyage. We have written this guide for you, so enjoy your journey!

What does this program contain?

This year, you will study space, the solar system, astronomers, our planet, geology, and meteorology in the following ways:

- ✓ Doing **hands-on science** through experiments and activities.
- ✓ Reading **scientific information** from visually appealing encyclopedias.
- ✓ Writing down what you have learned and seen using **organized notebooking**.

What does this guide contain?

At the beginning of this guide, you will find:

1. Date Sheets

For each unit, you will find:

2. The Unit Vocabulary Sheet
3. Weekly Student Assignment Sheets
4. Blank Sketches
5. Experiment Sheets
6. Space for the Writing Assignments

In the Appendix after the Unit Materials, you will find:

7. List of the Memory Work
8. The Glossary
9. A Place to Record Additional Activities

For a longer explanation of these components, see p. 7.

As the author and publisher of this curriculum, I encourage you to contact me with any questions or problems that you might have concerning *Earth Science & Astronomy 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 will enjoy *Earth Science & Astronomy for the Logic Stage*!

Sincerely,
Paige Hudson

Earth Science & Astronomy for the Logic Stage Student Guide

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Earth Science & Astronomy for the Logic Stage

A Deeper Look at the Components

How to Schedule this Study

Earth Science & Astronomy for the Logic Stage takes up to three hours per week. You, along with your teacher, can choose whether to complete the work over five days or over two days. Below are two options for scheduling to give you an idea of how you can schedule your week:

- ✓ A typical two-days-a-week schedule
 - ⌚ **Day 1** – Define the vocabulary, do the experiment, complete the experiment sheet, and record the dates.
 - ⌚ **Day 2** – Read assigned pages and discuss together, prepare the science report or outline, and complete the sketch.
- ✓ A typical five-days-a-week schedule
 - ⌚ **Day 1** – Do the experiment and complete the experiment sheet.
 - ⌚ **Day 2** – Record the dates and define the vocabulary.
 - ⌚ **Day 3** – Read assigned pages and discuss together and complete the sketch.
 - ⌚ **Day 4** – Prepare the science report or outline.
 - ⌚ **Day 5** – Complete one of the Want More activities from the Teacher Guide.

Student Assignment Sheets

The Student Assignment Sheets contain your weekly assignments for each week. Each of the student assignment sheets contains:

Do – Hands-on Science Activities

Experiment

Each week will revolve around a weekly topic. You will complete an assigned experiment that poses a question about what you are studying. Each Student Assignment Sheet contains the list of materials you will need and the instructions to complete the experiment. This guide also includes experiment sheets for you to fill out each week. In each of these experiments, you will use the scientific method.

A Word about the Scientific Method: The scientific method is a method for asking and answering scientific questions. Scientists achieve this by conducting observations and experiments. The following steps are key to the scientific method:

1. **Ask a Question** – The scientific method begins with asking a question about something you observe. Your questions must be about something you can measure. Good questions begin with how, what, when, who, which, why, or where.
2. **Do Some Research** – You need to read about the topic from your question so that you can have background knowledge of the topic. This will prevent you from

repeating the mistakes that people have made in the past.

3. **Formulate a Hypothesis** – A hypothesis is an educated guess about the answer to your question. Your hypothesis must be easy to measure and answer the original question you asked.
4. **Test with Experimentation** – Your experiment tests whether your hypothesis is true or false. It is important for your test to be fair. This means that you may need to run multiple tests. If you do, be sure to only change one factor at a time so that you can determine which factor is causing the difference.
5. **Record and Analyze Observations or Results** – Once your experiment is complete, you will collect and measure all your data to see if your hypothesis is true or false. Scientists often find that their hypothesis was false. If this is the case, they will plan a new hypothesis and begin the process again until they can answer their question.
6. **Draw a Conclusion** – Once you have analyzed your results, you can make a statement about them. This statement communicates your results to others.

Each of your experiment sheets will begin with a question and an introduction. The introduction will give you some background knowledge for the experiment. The experiment sheet also contains sections for the materials, a hypothesis, a procedure, an observation, and a conclusion. In the materials section, you need to fill out what you used to complete the experiment. In the hypothesis section, you need to predict the answer to the question posed in the lab. In the procedure section, you need to write a step-by-step account of what you did during your experiment. You need to provide enough detail so that someone else could read your report and replicate your experiment. In the observation section, you need to write what you saw and observed, as well as any results you measured. Finally, in the conclusion section, you need to write whether your hypothesis was correct and any additional information you have learned from the experiment. If your hypothesis was not correct, discuss why with your teacher and then include why your experiment did not work on your experiment sheet.

Safety Advisory—Do not perform any of the experiments marked “⚠️ **CAUTION**” on your own. Be sure you have adult supervision.

Want More Activities

Each week, you will find optional activities that relate to the topic. Your teacher will communicate with you if these activities are assigned for the week.

Read - Gathering Information

Main Reading Assignment

Each week, the student assignment page will give you a reading assignment for the topic from the spine texts, either *The Usborne Science Encyclopedia* or *The Kingfisher Science Encyclopedia*. After you have finished the assignment, discuss what you have read with your teacher. Your teacher may also assign additional research reading out of the following books:

-  *The Usborne Science Encyclopedia*, 2015 Edition (USE)
-  *The Kingfisher Science Encyclopedia*, 2017 Edition (KSE)
-  *The DK Encyclopedia of Science*, 2016 Edition (DKEOS)
-  *DK Eyewitness Books: Astronomy 2013 Edition* (DK Astro)
-  *Exploring the Night Sky*, 1987 Edition (ENS)

Vocabulary

Each week, you will be assigned vocabulary related to the topic. You will need to look up the word in the glossary on pp. 261-265 and fill out the definitions on the Unit Vocabulary Sheet found at the beginning of each unit. You may also want to make flash cards to help you work on memorizing these words.

Memory Work

Throughout the year, you will be assigned memory work for each unit. Simply repeat the selection until you have it memorized, and then say the selection to your teacher. There is a complete listing of the memory work selections in the Appendix on pp. 245-247.

Write - Notebooking Assignments

Writing Assignments

Each week, your teacher will assign either a list of facts, an outline, and/or a narrative summary after you discuss your reading assignment with them. Your outlines should be one-level main topic style outlines and your narrative summaries should be one to three paragraphs, unless otherwise assigned by your teacher.

Sketch

Each week, you will be assigned a sketch to complete. Color the sketch and label it with the information given on the Student Assignment Sheet. Be sure to give your sketch a title.

Dates to Enter

Each week, dates of important discoveries within the topic and dates from the readings are given on the student assignment sheet. You will enter these dates onto one of four date sheets. The date sheets are divided into the four time periods laid out in *The Well-Trained Mind* by Susan Wise Bauer and Jessie Wise (Ancients, Medieval-Early Renaissance, Late Renaissance-Early Modern, and Modern). These sheets are found in the ongoing projects section of this guide. You can choose to just write the dates and information on the sheet or you can draw a timeline in the space provided and enter your dates on that.

Sequence of Study

Astronomy Units (15 weeks)

Unit 1: Space (5 weeks)

- ✓ Universe
- ✓ Galaxies
- ✓ Stars
- ✓ Constellations
- ✓ Constellations: Research Project

Unit 2: Our Solar System (6 Weeks)

- ✓ Sun
- ✓ Inner Planets
- ✓ Earth/Moon
- ✓ Outer Planets
- ✓ Dwarf Planets
- ✓ Comets, Meteorites

Unit 3: Astronomers & Their Tools (4 Weeks)

- ✓ Astronomers
- ✓ Looking into Space
- ✓ Exploring Space
- ✓ Satellites

Earth Science Units (20 weeks)

Unit 4: Our Planet (7 weeks)

- ✓ Inside the Earth
- ✓ Maps and Mapping
- ✓ Rivers
- ✓ Oceans
- ✓ Glaciers
- ✓ Natural Cycles
- ✓ Biomes and Habitats

Unit 5: Geology (7 weeks)

- ✓ Continents
- ✓ Volcanoes
- ✓ Earthquakes
- ✓ Mountains
- ✓ Rocks
- ✓ Ores and Gems
- ✓ Erosion and Weathering

Unit 6: Weather (6 Weeks)

- ✓ Atmosphere
- ✓ Climates
- ✓ Weather
- ✓ Clouds
- ✓ Extreme Weather
- ✓ Forecasting

Review (1 week)

Ancients 5000 BC-400 AD

Medieval-Early Renaissance 400AD-1600AD

Late Renaissance-Early Modern 1600 AD-1850 AD

Modern 1850 AD-Present

Astronomy *Unit 1*

Space

Astronomy Unit 1: Space Vocabulary Sheet

Define the following terms as they are assigned on your Student Assignment Sheet.

1. Universe – _____

2. Galaxy – _____

3. Cluster – _____

4. Supercluster – _____

5. Star – _____

6. Nebulae – _____

7. Black hole – _____

8. Constellation – _____

9. Planetarium – _____

10. Zodiac – _____

Student Assignment Sheet Astronomy Week 1 Universe

Do - Hands-on Science Activities

- ☐ **Experiment:** Can I calculate the speed of light using a microwave?

Materials

✓ Large chocolate bar, Large plate, Microwave, Ruler

(Note—*Melted chocolate is very hot and can burn. Please use caution.*)

- ☐ **Want More Activities:** See your teacher for additional information about observing the universe.

Read - Gathering Information

- ☐ **Main Reading Assignment:** *Kingfisher Science Encyclopedia* p. 386-387 (The Universe)

Optional Research Readings

📖 Big Bang Theory: *KSE* p. 388-389

📖 The Universe: *USE* p. 154-155

- ☐ **Vocabulary:** universe
- ☐ **Memory Work:** This week, work on memorizing the Types of Stars.
1. Blue giant – A large, hot star off the main sequence.
 2. Red giant – An older star with a cooler outer layer.
 3. Neutron star – The tightly-packed collapsed core of a larger star.
 4. Main-sequence star – A star plotted in the left-to-right band across the HR diagram.
 5. Black hole – A gravitationally dense region of space-time where nothing can escape, not even light.
 6. White dwarf – A stellar core remnant of a low to medium mass star.
 7. Red dwarf – A cool, small star on the main sequence.

Write - Notebooking Assignments

- ☐ **Writing Assignments:** Write a list of facts, an outline, or a report.

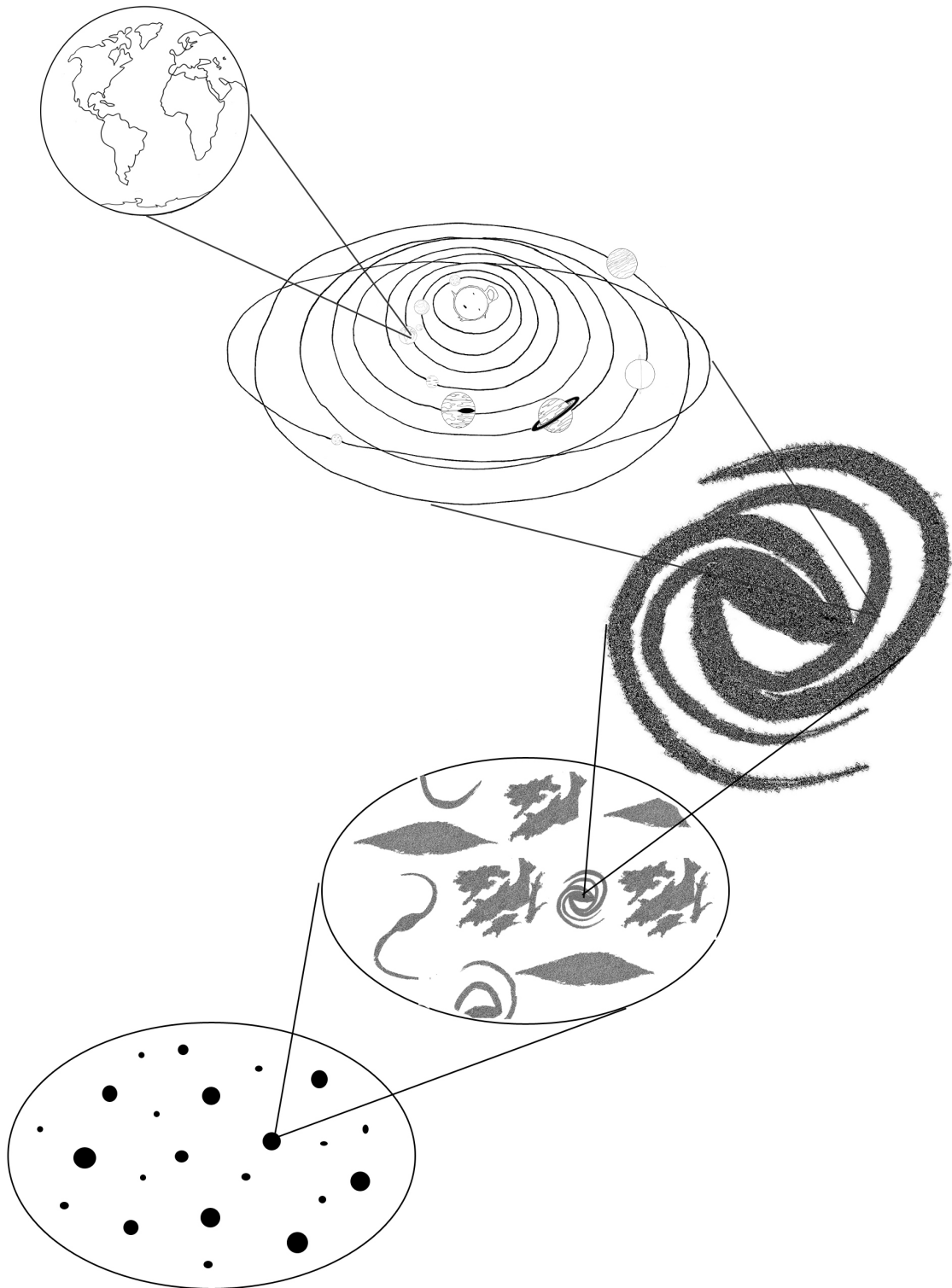
- ☐ **Sketch:** Contents of the Universe

✎ Label the following: Earth, Our Solar System, Milky Way Galaxy, Cluster of Galaxies, The Universe

- ☐ **Dates to Enter**

- 🕒 1929 – Edwin Hubble proves that the universe is expanding.
- 🕒 1965 – Scientists find heat waves in the universe that they believe are leftover from a vast explosion.
- 🕒 1992 – The satellite *Cosmic Background Explorer* traces background radiation and ripples in the universe that are thought to be leftover from the Big Bang.

Sketch Assignment Week 1



Experiment: Can I calculate the speed of light using a microwave?

Introduction

The universe is the vast expanse of space in which all things are found. It contains us, our planet, our solar system, our galaxy and at least 100 billion other galaxies. Astronomers have studied what they call the observable universe since Galileo invented the first telescope in 1609. As astronomers began to record their observations, they found the need to calculate distances, so that they could give approximate locations for the objects in the universe. Since the distances in the universe are so large, astronomers began to use light years to calculate them. A light year is the distance a wavelength of light will travel in one year, or about 5.88 trillion miles. In this experiment, you are going to try to calculate the speed of light, which scientists then multiply by the time in one year to calculate a light year.

Hypothesis

Can I calculate the speed of light using a microwave?	Yes	No
---	-----	----

Materials

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Procedure

1. Unwrap the chocolate bar and place it on the plate. Remove the turntable from your microwave and set the plate inside.
2. Begin by heating the chocolate bar for 1 minute; check to see if it has begun to melt. (**Note**—*You are looking to see if there are two spots that have begun to melt. You DO NOT want the entire chocolate bar to melt.*) If the bar has not begun to melt, continue to heat it for 30-second intervals, checking each time to see if melting has begun.
3. Once melting has begun, carefully remove the plate from the microwave and measure the

 **CAUTION**
Melted chocolate is very hot and can burn, DO NOT touch!

distance between the centers of the two melted points.

4. Record the distance on your experiment sheet and complete the calculations.

Observations

Distance from the center of one melted chocolate spot to the center of the next melted chocolate spot	
in cm (centimeters)	
in m (meters)	

Results

Calculation #1: _____ x 2 = _____
(distance measured in m) (wavelength in m)

Calculation #2: _____ x 1,000,000 (Hz/MHz) = _____
(Mega Hertz(MHz), from the back of the microwave) (Cycles per second in Hz)

Calculation #3: _____ x _____ = _____
(wavelength in m) (Cycles per second in Hz) (speed of light m/s)

Conclusion

Written Assignment Week 1

[illegible]

Student Assignment Sheet Astronomy Week 2 Galaxies

Do - Hands-on Science Activities

- ☐ **Experiment:** Identifying Galaxies

Materials

✓ Galaxy cards (Your instructor will provide these cards.)

- ☐ **Want More Activities:** See your teacher for games you can play with the galaxy cards and a deep space art project.

Read - Gathering Information

- ☐ **Main Reading Assignment:** *Kingfisher Science Encyclopedia* p. 390-391 Galaxies

Optional Research Readings

📖 Galaxies: *USE* p. 156-157

📖 Our Galaxy and Beyond: *DK Astro* p. 62-63

- ☐ **Vocabulary:** galaxy, cluster, supercluster
- ☐ **Memory Work:** This week, continue to work on memorizing the Types of Stars.

Write - Notebooking Assignments

- ☐ **Writing Assignments:** Write a list of facts, an outline, or a report.
- ☐ **Sketch:** 4 Types of Galaxies
 - ✍ Label the following: irregular galaxy, elliptical galaxy, spiral galaxy and barred spiral galaxy
- ☐ **Dates to Enter**
 - 🕒 1784 – Charles Messier finds several blurry objects that he records as nebulae. These are later discovered to be galaxies.
 - 🕒 1845 – Lord Rosse draws the galaxy M51, without knowing what it is.
 - 🕒 1924 – Edwin Hubble presents the first evidence of other galaxies.

Sketch Assignment Week 2



Experiment: Identifying Galaxies

Introduction

All galaxies are massive celestial bodies made up of stars, gas and dust. They are held together by gravity and classified by their shape. There are four main types of galaxy shapes, spiral, elliptical, barred spiral, and irregular. In this experiment, you are going to read more about each type of galaxy shape and then identify several galaxies using what you have learned.

Procedure

1. Read “Four Types of Galaxies” found on p. 248 of the Appendix.
2. Fill in the Galaxy Information Chart on your experiment sheet with the information.
3. Next, look at each of the galaxy cards, determine which type of galaxy they are by using the information included.
4. Then check your answers with your teacher.

Conclusion

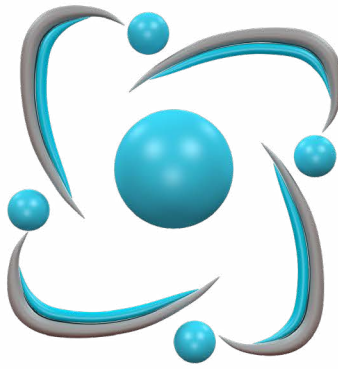
This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

Galaxy Information Chart

Type of Galaxy				
Shape				
Presence of Bulges & Discs				
Presence of Gas & Dust				
Types of Stars				
Examples (from Galaxy Cards)				

Written Assignment Week 2

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



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