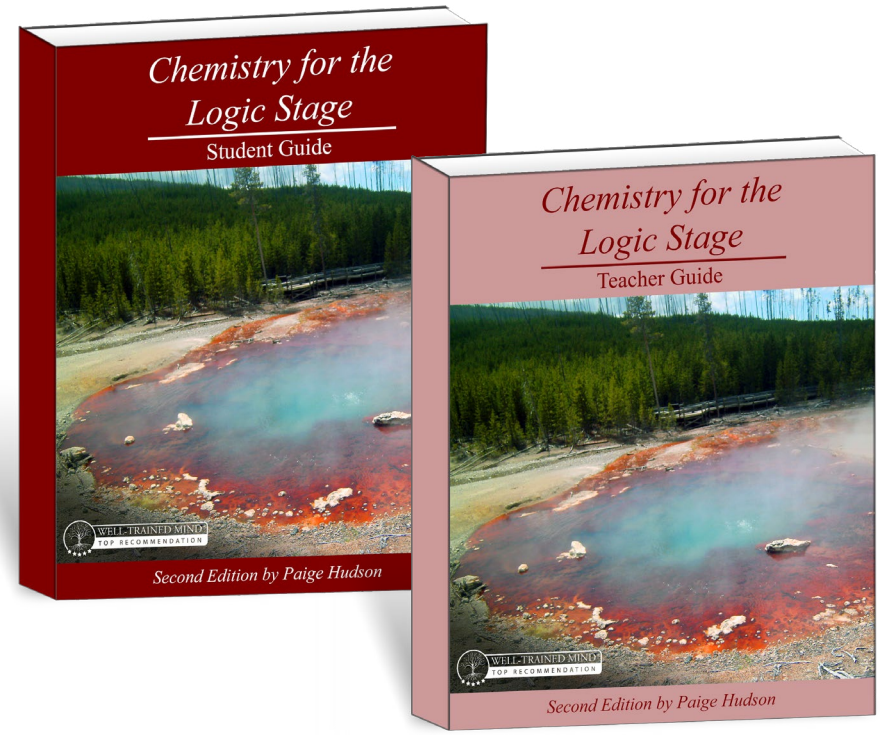

Chemistry for the Logic Stage Sample Packet

The following sample packet includes the first two weeks of the *Chemistry for the Logic Stage* materials. You will see:

- ✓ The Teacher Guide (*beginning on pg. 3*)
- ✓ The Student Guide (*beginning on pg. 32*)

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

https://elementalscience.com/collections/chemistry-for-the-logic-stage

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Quick Start Guide

In a Nutshell

Learn about the periodic table, matter, solutions, chemical reactions, acids, bases, the chemistry of life, and the chemistry of industry through the following:

- ✓ Gathering information through reading the main spines.
- ✓ Doing hands-on science through experiments and projects.
- ✓ Keeping a record of what the students have learned.

See pp. 17-18 for a complete list of the topics explored in this program.

What You Need

In addition to this guide, you will need the following:

1. A guide for the students. (You can purchase the *Chemistry for the Logic Stage Student Guide* to have it all laid out for you or just buy a composition book.)
2. The two spines:

   📖 *Usborne Science Encyclopedia, 2015 Edition* (USE)
   📖 *Usborne Illustrated Dictionary of Science, 2012 Edition* (UIDS)

   You can also purchase the *Kingfisher Science Encyclopedia, 2017 Edition* (KSE) for optional reading assignments. Head to the page below to get links to these books:

   💻 https://elementalscience.com/blogs/resources/cls
3. The experiment supplies (See a full list starting on pg. 19 or save yourself the time and purchase the *Chemistry for the Logic Stage Experiment Kit*.)

How It Works

Each week you will . . .

- Guide the students as they do an experiment using the directions on the Student Assignment Sheet—this is in this guide as well as the student guide. The results and an explanation of the experiment are part of the additional information in this guide.
- Assign the reading, and when the students are finished, you will discuss what they read using the questions and answers in this guide.
- Assign appropriate written work—a list of facts, an outline, or a report.
- Assign vocabulary, memory work, and dates to add to a timeline.

You can add to their learning experience by also doing the additional activities suggested in this guide. For a more detailed explanation of the components of your week, we highly recommend reading the introduction starting on pg. 7 of this guide.

Chemistry for the Logic Stage Teacher Guide
Table of Contents

Chemistry 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' brain 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. *Chemistry 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 the 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 your student.
4. **The Science Project —** Once a year, all middle school student should complete a science project. Their project should work through the scientific method from start to finish on a basic level, meaning that their question should be relatively easy to answer. The science fair project, scheduled as a part of unit seven fulfills the requirements of this component.

Chemistry 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

[1]Bradley R. Hudson & Paige Hudson, Success in Science: A Manual for Excellence in Science Education, (Elemental Science, 2012) 52

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 chemistry while teaching the basics of the scientific method. During the years, your students will work on their observation skills, learn to think critically about the information they are studying and practice working independently. *Chemistry for the Logic Stage* is intended to be used with seventh through eighth grade students.

What this guide contains 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 your 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 your students through *Chemistry for the Logic Stage*.

What the Student Guide contains

The Student Guide, which is sold separately, is designed to encourage independence in your students as they complete *Chemistry 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 your students will need and 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 your students are studying. Each of the student assignment sheets contains the following:

- ✓ **Experiment**

  Each week will revolve around a weekly topic that it to be studied. Your student will be assigned an experiment that poses a question related to the topic. Each of these experiments will walk your students through the scientific method (see the Appendix pg. 249 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 your student to look at all the facts and results before drawing a conclusion. If this sounds intimidating, it's not. You are simply teaching your 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 your students to fill out. Each experiment sheet contains an introduction that is followed by a list of materials, a hypothesis, a procedure, an observation and a conclusion section.

The introduction will give your 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, your 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 experiment, so that someone else could read their report and replicate their experiment. In the observation section, your students will write what they saw. Finally, in the conclusion section they will write whether or not their hypothesis was correct and share any additional information they have learned from the experiment. If the students' hypothesis was not correct, discuss why and have them include that on their experiment sheet.

Vocabulary & 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 your students also make flash cards to help them work on memorizing the words. This year, the students will memorize the elements of the periodic table along with specific information relating 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. So, these sketch assignments should make the student think. This guide contains a completed sketch for you to use when checking their work.

Writing

Each week the students will be assigned pages to read from the spine text, the *Usborne Science Encyclopedia* or the *Usborne Illustrated Dictionary of Science*. 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 your students' written assignment:

- ***Option 1: Have the students write an outline from the spine text***
  A typical seventh 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 seventh 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. In addition to the main spines, the following encyclopedia is scheduled to be used as an additional reference book:

📖 *The Kingfisher Science Encyclopedia, 2017 Edition* (KSE)

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 do school, either in science or in another subject. So, 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' report, 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 form). 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 report, have them glue a copy of it 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. 246-248.

Schedules

Chemistry for the Logic Stage is designed to take up to 5 hours per week. You and your 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 your 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.

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:

☞ **Experiment Information**

Each week, the Additional Information Section includes the expected experiment results and an explanation of those results for you to use with the students. When possible, you will also find suggestions on how to expand the experiment in the Take if Further section.

🗣 **Discussion Questions**

Each week the Additional Information Section includes possible discussion questions from the main reading assignment, along with the answers. These are designed to aid you in leading the discussion time with the students. I recommend that you encourage them to

answer in complete sentences, as this will help them organize their thoughts for writing their outline or report. I have also included a list of the discussion questions without the answers at the end of each unit's material in this guide. This is so you can give them to your students ahead of time, if you desire, or you can use them to review for the unit test. If they are already writing outlines or lists of facts, you do not need to have them write out the answers to the discussion questions before hand as there is plenty of writing required in this program already.

Want More

Each week, the Additional Information Section includes a list of activities under the Want More section. ***These activities 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 guide, so it is up to you whether or not to assign these.

☑ **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 if you feel the need to do so. The tests and the 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.

What a Typical Two-day Schedule Looks Like

A typical two-day schedule will take one-and-a-half to two hours per day. Here is a breakdown of how a normal two-day week would work using week three:

- **Day 1:** ***Define the vocabulary, record the dates, do the experiment, and complete the experiment sheet***

  Begin day 1 by having the students do the "Can I transfer metal atoms?" experiment. Have them read the introduction and perform the experiment using the directions provided. Next, have them record their observations and results. After they discuss their results with you, have them write a conclusion for their experiment. Finish the day by having them look up and define "metal" using the glossary in the Student Guide and add the dates to their date sheets.

- **Day 2:** ***Read the assigned pages, discuss together, prepare an outline, or narrative summary and complete the sketch***

  Begin by having the students read pp. 168,170, 172-173 in the *Usborne Illustrated Dictionary of Science*. Then, using the questions provided, discuss what they have read. Next, 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:

Alkali, Alkaline Earth, and Transition Metals

Alkali metals are metals that react with water to form alkaline solutions. They are typically soft, silver-white metals. The further down the group, the more reactive the alkali metal elements are.

Alkali metals are used in a variety of products. Lithium is used in welding flux. Sodium is used as a coolant in nuclear power plants. Potassium is used to make soap. Rubidium is used to make a special type of glass. Cesium is used in photocells. Francium, the final alkali metal does not have a known stable isotope.

Alkaline earth metals are reactive metals. With the exception of Beryllium, which is a hard, white metal, the alkaline earth metals are soft, silver-white metals. The further down the group, the more reactive the alkaline earth metal elements are.

Alkaline earth metals are found in many places and have many uses. Beryllium is used in corrosion-resistant alloys. Magnesium is found in rocks and seawater. Calcium is found in chalk, milk, and bones. Strontium is used in fireworks. Barium is used in medicine. And, radium is used to treat cancer.

Transition metals are all hard, tough, shiny, and malleable metals. These metals also typically conduct heat and electricity. The transition metals also tend to have high melting points, boiling points, and densities. The inner transition metals are rare and often unstable.

Transition Metals are used in a variety of ways. Many transition metals are used in alloys. Many transition metals are used as catalysts. Some transition metals are used in electroplating.

What a Typical Five-day Schedule Looks Like

A typical five-day schedule will take forty-five minutes to one hour per day. Here is a breakdown of how a normal five-day week would work using week three...

- **Day 1:** ***Do the experiment and complete the experiment sheet***
  Begin day 1 by having the students do the "Can I transfer metal atoms?" experiment. Have them read the introduction and perform the experiment using the directions provided. Next, have them record their observations and results, 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. 168,170, 172-173 in the *Usborne Illustrated Dictionary of Science* and 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 outline:

Alkali Metals

I. Alkali metals include the Group 1 elements on the periodic table.
   A. All metals are metals that react with water to form alkaline solutions.

i. The further down the group, the more reactive the alkali metal elements are.

B. Alkali metals are typically soft, silver-white metals.

II. Alkali metals are used in a variety of products.
A. Lithium is used in welding flux.
B. Sodium is used as a coolant in nuclear power plants.
C. Potassium is used to make soap.
D. Rubidium is used to make a special type of glass.
E. Cesium is used in photocells.

Alkaline Earth Metals

I. Alkaline earth metals include the Group 2 elements on the periodic table.
A. Alkaline earth metals are reactive metals.
i. The further down the group, the more reactive the alkaline earth metal elements are.
B. With the exception of Beryllium, which is a hard, white metal, the alkaline earth metals are soft, silver-white metals.

II. Alkaline earth metals are found in many places and have many uses.
A. Beryllium is used in corrosion-resistant alloys.
B. Magnesium is found in rocks and seawater.
C. Calcium is found in chalk, milk and bones.
D. Strontium is used in fireworks.
E. Barium is used in medicine.
F. Radium is used to treat cancer.

Transition Metals

I. Transition metals include the center block of elements on the periodic table.
A. Transition metals are all hard, tough, shiny, and malleable metals.
B. These metals also typically conduct heat and electricity.
C. The transition metals also tend to have high melting points, boiling points, and densities.
D. The inner transition metals are rare and often unstable.

II. Transition Metals are used in a variety of ways.
A. Many transition metals are used in alloys.
B. Many transition metals are used as catalysts.
C. Some transition metals are used in electroplating.

- **Day 3:** ***Record the dates, define the vocabulary, and complete the sketch***
  Begin by having the students look up and define "metal" using the glossary in the Student Guide and 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 "Metals" from *KSE* pp. 183, "Copper" from *KSE* pg.

199, or "Metals" from *USE* pp. 30-31. Then, have the students use their outline along with what they have just read to write a 3 to 5 paragraph summary of what they have learned;

- **Day 5:** ***Complete one of the Want More activities***
  Have the students make several Element Trading Cards or have them watch the video about alkali metals. You could also have them read about a scientist from the field of chemistry.

The Science Fair Project

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

How to Include Your Younger Students

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

- ***Option 1: Have your younger students use Chemistry for the Grammar Stage***
  I recommend this option if your younger students are in the second through fourth grade and/or your older students are ready for some independence. The units in *Chemistry for the Grammar Stage* will not match up with the units in *Chemistry for the Logic Stage*, so you will need to do each program as written;
- ***Option 2: Have your younger students use Chemistry for the Logic Stage along with your older students***
  I recommend this option if your younger students are in the fourth through sixth grade and/or your older students are not ready to work independently. However, you will need to adjust the work load for your younger students. Here are some suggestions on how to do that:
  - ✓ Have them watch and observe the experiments;
  - ✓ 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 them 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 your younger students. If so, you can read to them out of the *DK Smithsonian Science: A Visual Encyclopedia*. I have included a chart coordinating this resource in the Appendix on pp.250-252.

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 blogs. As you prepare to guide your students through this program, you may find the following articles 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.
  http://elementalblogging.com/classical-science-curriculum-logic/
- *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
- *Writing in Homeschool Science: The Middle School Years and Beyond* – This podcast (and video) explains the goals of writing for logic stage science.
  https://elementalscience.com/blogs/podcast/episode-13
- *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/
- *3 Tips to Encourage Independent Learning* – This podcast gives you tips to help your students make the move from dependent to independent learning.
  https://elementalscience.com/blogs/podcast/87

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/cls

Final Thoughts

If you find that this program contains too much work, please tailor it to the needs of your student. As the author and publisher of this curriculum I encourage you to contact me with any questions or problems that you might have concerning *Chemistry 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 student enjoy *Chemistry for the Logic Stage*!

Safety Advisory

Many of the experiments in this book use boiling water or open flames. We recommend that your students use safety glasses and protective gear with each experiment to prevent accidents. Do not allow your students to perform any of the experiments marked "☣ **CAUTION**" on their own.

Units of Measurement

What are the two measuring systems?

- **The Standard or Standard American Engineering (SAE) System —** This system is used mainly in the United States and it uses units like inches, pounds and gallons. It was derived from an early English measuring system that has its roots in the Roman system of measurements.
- **The Metric System —** This system is used in most of the world and it uses units like meters, grams and liters. The system is base 10 and their names are formed with prefixes. It was derived from one of the early French measuring systems.

In the US, the standard system of units are more widely used on consumer products and in industrial manufacturing, while the metric system is more widely used in science, medicine and government. Since this program has been published in the US, I have used the standard system of measurement throughout for familiarity. However, because I believe that it is important for our students to be familiar with both systems, I have included metric measurements in parentheses.

What about converting units?

Every student should know how to convert measurements inside of a given measuring system, such as knowing how to convert grams to kilograms or ounces to pounds. Normally, these conversion factors are taught as a part of your math program. However, I also recommend that you have your students memorize several basic conversion factors between the two systems. Here is a list of factors that the students should try to memorize:

- **Pounds to Kilograms:** 1 lb = 2.2 kg
- **Ounces to Grams:** 1 oz = 28.3 g
- **Gallons to Liters:** 1 gal = 3.785 L
- **Cups to Milliliters:** 1 c = 240 mL
- **Miles to Kilometers:** 1 mi = 1.61 km
- **Feet to Meters:** 1 ft = 0.305 m
- **Inches to Centimeters:** 1 in = 2.54 cm

With the global flow of information that occurs these days, it is very important for students to learn these most basic conversion factors. To learn more about the importance of units of measurement in science, read the following blog post:

https://elementalscience.com/blogs/science-activities/units-of-measurement

Sequence of Study

Building Blocks of Chemistry (9 weeks)

Unit 1: The Periodic Table (5 Weeks)
- ✓ Elements, Atoms and Ions
- ✓ The Periodic Table
- ✓ Metals
- ✓ The Inbetweens
- ✓ Halogens and Noble Gases

Unit 2: Matter (4 Weeks)
- ✓ States of Matter
- ✓ Properties of Matter
- ✓ Kinetic Theory and Gases
- ✓ Crystals

Principles in Chemistry (14 weeks)

Unit 3: Solutions (4 Weeks)
- ✓ Compounds and Mixtures
- ✓ Solutions
- ✓ Separating Mixtures
- ✓ Electrolysis

Unit 4: Chemical Reactions (6 Weeks)
- ✓ Chemical Bonding
- ✓ Chemical Reactions
- ✓ Reactivity
- ✓ Catalysts
- ✓ Oxidation and Reduction

Unit 5: Acids and Bases (4 weeks)
- ✓ Acids
- ✓ Bases
- ✓ Measuring Acidity (pH)
- ✓ Neutralization and Salts

Applications for Chemistry (12 weeks)

Unit 6: Chemistry of Life (4 Weeks)
- ✓ Organic Chemistry

- ✓ Enzymes
- ✓ Chemistry of Food
- ✓ Fermentation

Unit 7: Chemistry of Industry (8 weeks)

- ✓ Soaps and Detergents
- ✓ Alkanes and Alkenes
- ✓ Homologous Groups
- ✓ Petrochemicals
- ✓ Polymers and Plastics
- ✓ Iron and Alloys
- ✓ Radioactivity
- ✓ Pollution

Note—*This unit also contains a science fair project and a scientist biography project for the students to complete.*

Materials Listed by Week

Building Blocks of Chemistry

Unit 1: The Periodic Table

Week	Materials
1	Heavy cream, Milk, Sugar, Vanilla, 1 small and 1 large zip-locking plastic bag, Crushed ice, Dish towel or oven mitt, Rock salt
2	*No supplies needed.*
3	Vinegar, Salt, 6 pennies, Glass cup, 2 iron nails
4	Magnet, Materials for circuit (Flashlight bulb, Copper wire, D battery, Electrical tape), Hammer, Paper folded into a small square, Metal paperclip (not plastic coated), Aluminum foil, CD, Safety glasses
5	Element cards (homemade or purchased)

Unit 2: Matter

Week	Materials
6	Cup, Ice Cubes, Pot, Thermometer
7	4 clear cups, Eye dropper, Table salt, Food coloring, Water
8	2 cups, Apple juice, Timer, Partner
9	String, Wide mouthed jar, Pencil, Pipe cleaners, Water, Borax, Scissors

Principles in Chemistry

Unit 3: Solutions

Week	Materials
10	Bag of multi-colored marshmallows, Toothpicks
11	5 clear cups (or beakers), 5 plastic spoons, Sugar, Salt, Baking powder, Flour, Cornstarch, Water, Vegetable oil, Tablespoon
12	Coffee filters, Markers, Alcohol, Coffee can or wide-mouthed jar, Rubber bands, Eyedropper
13	Distilled water, 2 test tubes, Salt, Glass cup, 2 Alligator clips, Covered copper wire, 6-volt Lantern battery, Permanent marker

Unit 4: Chemical Reactions

Week	Materials
14	Cake frosting, Red and yellow bite-sized candies
15	Yeast, Hydrogen peroxide, Epsom salts, Water, 2 cups, 2 thermometers
16	Baking soda, Chalk, Iron nail (non-coated), Copper penny, White vinegar, 4 cups

Week	Materials
17	2 potatoes, Pot, Water, Oven mitt, Large Slotted Spoon
18	Carbonated water, Sugar, 2 cups
19	Steel wool, Vinegar, Jar with lid, Ammonia, Hydrogen peroxide,

Unit 5: Acids and Bases

Week	Materials
20	Cranberry juice, Lemon juice, Baking soda, Clear cup
21	6 cups, Red cabbage solution, Water, Vinegar, Baking soda, Sprite, Ammonia, Lemon Juice, Eye dropper
22	Lemon, Tomato, Saliva, Milk, Bleach, Toothpaste, Liquid Dish Soap, pH paper, Gloves
23	Vinegar, Ammonia, Red cabbage solution, Water, Safety glasses

Applications for Chemistry

Unit 6: Chemistry of Life

Week	Materials
24	Sugar, Salt, Candle, 2 metal spoons, Hot mitt
25	2 slices of bread, Water, Saliva, 2 plastic bags
26	Benedict's solution, Iodine solution, Several different types of food for testing (such as a hard-boiled egg, bread, potato, pasta, yogurt, cookies or cheese), Eyedropper, Small plastic cups, Safety glasses
27	Yeast, Water, Sugar, 3 bottles, 3 balloons, Instant read thermometer, Pot, Hot mitt

Unit 7: Chemistry of Industry

Week	Materials
28	Powdered detergent, Liquid soap, 2 large cups, 2 small cups, 2 bowls, pH paper, Vegetable oil, Dirt, Ketchup, Plaster of Paris, Water, Straw, Old T-shirt fabric
29-36	Materials will vary depending on the Science Fair Project that your student has chosen to do.
33-35	*No supplies needed.*

Chemistry: Unit 1

The Periodic Table

Unit 1: The Periodic Table
Overview of Study

Sequence of Study

Week 1: Atoms
Week 2: The Periodic Table
Week 3: Metals
Week 4: The Inbetweens
Week 5: Halogen and Noble Gases

Materials by Week

Week	Materials
1	Heavy cream, Milk, Sugar, Vanilla, 1 small and 1 large zip-locking plastic bag, Crushed ice, Dish towel or oven mitt, Rock salt
2	*No supplies needed.*
3	Vinegar, Salt, 6 pennies, Glass cup, 2 iron nails
4	Magnet, Materials for circuit (Flashlight bulb, Copper wire, D battery, Electrical tape), Hammer, Paper folded into a small square, Metal paperclip (not plastic coated), Aluminum foil, CD, Safety glasses
5	Element cards (homemade or purchased)

Vocabulary for the Unit

1. **Atom –** The smallest particle of an element that retains the chemical properties of the element.
2. **Electron Shell –** A region around the nucleus of an atom where a specific number of electrons can exist.
3. **Element –** A substance made up of one type of atom, which cannot be broken down by chemical reaction to form a simpler substance.
4. **Compound –** A substance made up of two or more different elements that are chemically joined in fixed proportions.
5. **Period –** A set of elements that have the same number of electron shells, shown as rows in the periodic table.
6. **Group –** A column of elements in the periodic table that have similar properties, electron configurations and valencies.
7. **Atomic Number –** The number of protons in the nucleus of an atom.
8. **Atomic Mass –** The average mass number of the atoms in a sample of an element.
9. **Metal –** The largest class of elements, usually they are shiny and solid at room temperature.
10. **Poor Metal –** A group of metals that are soft and weak.
11. **Semimetal –** A group of elements that have characteristics of both metals and nonmetals.

12. **Malleable –** A characteristic of a metal that means it is bendable and easily shaped.
13. **Semiconductor –** A substance that only conducts electricity under certain conditions.
14. **Nonmetal –** A class of elements that typically forms negative ions; they are usually dull solids or gases.

Memory Work for the Unit

The Elements of the Periodic Table – The following elements will be memorized in this unit:

- ✓ 1-H-Hydrogen
- ✓ 2-He-Helium
- ✓ 3-Li-Lithium
- ✓ 4-Be-Beryllium
- ✓ 5-B-Boron
- ✓ 6-C-Carbon
- ✓ 7-N-Nitrogen
- ✓ 8-O-Oxygen
- ✓ 9-F-Fluorine
- ✓ 10-Ne-Neon
- ✓ 11-Na-Sodium
- ✓ 12-Mg-Magnesium
- ✓ 13-Al-Aluminum
- ✓ 14-Si-Silicon
- ✓ 15-P-Phosphorus
- ✓ 16-S-Sulfur
- ✓ 17-Cl-Chlorine
- ✓ 18-Ar-Argon
- ✓ 19-K-Potassium
- ✓ 20-Ca-Calcium

Student Assignment Sheet Week 1
Atoms

Experiment: Making Ice Cream

Materials:

- ✓ Heavy cream
- ✓ Milk
- ✓ Sugar
- ✓ Vanilla
- ✓ Crushed ice
- ✓ 1 small & 1 large zip-locking plastic bag
- ✓ Dish towel or oven mitt
- ✓ Rock salt

Procedure:

1. Mix together the ½ cup cream (120 mL), 1 cup milk (240 mL), ½ cup sugar (225 g) and 1 tsp vanilla (5 mL) in the small zip-locking plastic bag. Then, add the crushed ice and rock salt to the large zip-locking plastic bag. (***Note—****Make sure that the air is removed from both bags and they are sealed tightly.*)
2. Place the smaller bag with the cream mixture inside the larger bag with the ice. Cover the outside of the bag with the dish towel (or put on the oven mitt) and massage or shake the bag until the cream mixture has frozen. It should take about 5 to 10 minutes.
3. Take the smaller bag out of the larger bag, wipe off the salt water, open, eat and enjoy!

Vocabulary & Memory Work

- ☐ Vocabulary: atom, electron shell, element, compound
- ☐ Memory Work—This year you will be memorizing the elements that make up the periodic table, along with their atomic number and symbol. This week, work on the following elements:
  - ✓ 1-H-Hydrogen, 2-He-Helium, 3-Li-Lithium, 4-Be-Beryllium

Sketch: Parts of an Atom

- 🖼 Label the following: electron orbit, nucleus, electron shell, and the electron, proton, and neutron at the bottom of the page

Writing

- Reading Assignment: *Usborne Illustrated Dictionary of Science* pp. 126-127 (Atomic Structure)
- Additional Research Readings:
  - 🕮 Atomic Structure: *USE* pg. 10-14
  - 🕮 Atoms: *KSE* pp. 150-151

Dates

- 🕒 340 BC – Aristotle proposes that all substances are made up of combinations of four elements: earth, air, water and fire.
- 🕒 1766-1844 – John Dalton lives. He is responsible for writing the first atomic theory.
- 🕒 1897 – J.J. Thompson discovers the electron.
- 🕒 1909 – Rutherford, along with two other scientists, discovers the nucleus of an atom.
- 🕒 1913 – Niels Bohr comes up with the Bohr model of an atom.

Schedules for Week 1

Two Days a Week

Day 1	Day 2
☐ Do the "Making Ice Cream" experiment ☐ Define atom, electron shell, element, and compound on SG pg. 16 ☐ Enter the dates onto the date sheets on SG pp. 8-13	☐ Read pp. 126-127 from *UIDS,* then discuss what was read ☐ Color and label the "Parts of an Atom" sketch on SG pg. 19 ☐ Prepare an outline or narrative summary, write it on SG pp. 20-21
Supplies I Need for the Week ✓ Heavy cream, milk, sugar, vanilla ✓ 1 small & 1 large zip-locking plastic bag ✓ Crushed ice, dish towel or oven mitt, rock salt	
Things I Need to Prepare	

Five Days a Week

Day 1	Day 2	Day 3	Day 4	Day 5
☐ Do the "Making Ice Cream" experiment ☐ Enter the dates onto the date sheets on SG pp. 8-13	☐ Read pp. 126-127 from *UIDS,* then discuss what was read ☐ Write an outline on SG pg. 20	☐ Define atom, electron shell, element, and compound on SG pg. 16 ☐ Color and label the "Parts of an Atom" sketch on SG pg. 19	☐ Read one or all of the additional reading assignments ☐ Write a report from what you learned on SG pg. 21	☐ Complete one of the Want More Activities listed **OR** ☐ Study a scientist from the field of Chemistry
Supplies I Need for the Week ✓ Heavy cream, milk, sugar, vanilla ✓ 1 small & 1 large zip-locking plastic bag ✓ Crushed ice, dish towel or oven mitt, rock salt				
Things I Need to Prepare				

Additional Information Week 1

Notes

- **Atoms vs. Elements –** Elements are substances that are made up of one type of atom, while atoms are the smallest particles of an element that retain the chemical properties of the element. In other words an element is composed of one or more of the same type of atom. So, when you hold a lump of iron, you are holding the element iron that contains billions of iron atoms. See the following article for more information:
  - http://elementalblogging.com/science-corner-element-and-atom/

Experiment Information

- **Explanation –** This experiment was meant for the students to see how much fun chemistry can be. The students will explore liquids, solids, and freezing in Unit 2, so let this just be a enjoyable experience.
- **Troubleshooting Tips –** Use thick plastic bags so that there is less risk of one of the bags being punctured by the ice or salt. If you can't find rock salt, you can use regular table salt instead, but be aware that it may take longer for the cream mixture to freeze.

Discussion Questions

1. What is an atom? (*UIDS pg. 126 - An atom is a microscopic particle that is made up of smaller subatomic particles called electrons, protons, and neutrons*.)
2. What is the basic structure of an atom according to modern atomic theory? (*UIDS pg. 126 - Atoms have a nucleus at the center that is composed of neutrons and protons. They have electrons that fly around the nucleus in different shells or layers*.)
3. What are the charges of the subatomic particles (i.e., protons, neutrons, and electrons)? (*UIDS pg. 126 - Protons are positively charged, electrons are negatively charged, and neutrons are neutral.*
4. What is an electron shell? (*UIDS pg. 126 - An electron shell is the region of space around the nucleus of an atom where the electrons move around.*)
5. What is an orbital? (*UIDS pg. 127 - An orbital is a region in an electron shell where one or two electrons can be found.*)
6. What is an octet, and why is it important in chemistry? (*UIDS pg. 127 - An octet is a group of eight electrons in a single electron shell. It is important because atoms with an octet in their outer electron shell are very stable and unreactive.*)
7. What is the difference between atomic number and mass number? (*UIDS pg. 127 - Atomic number tells you the number of protons in a nucleus, while mass number tells you the total number of protons and neutrons in one atom of an element.*)
8. What is an isotope? (*UIDS pg. 127 - An isotope is an atom of an element that has a different number of neutrons than another atom of the same element. Isotopes have the same atomic number, but different mass numbers.*)

Want More

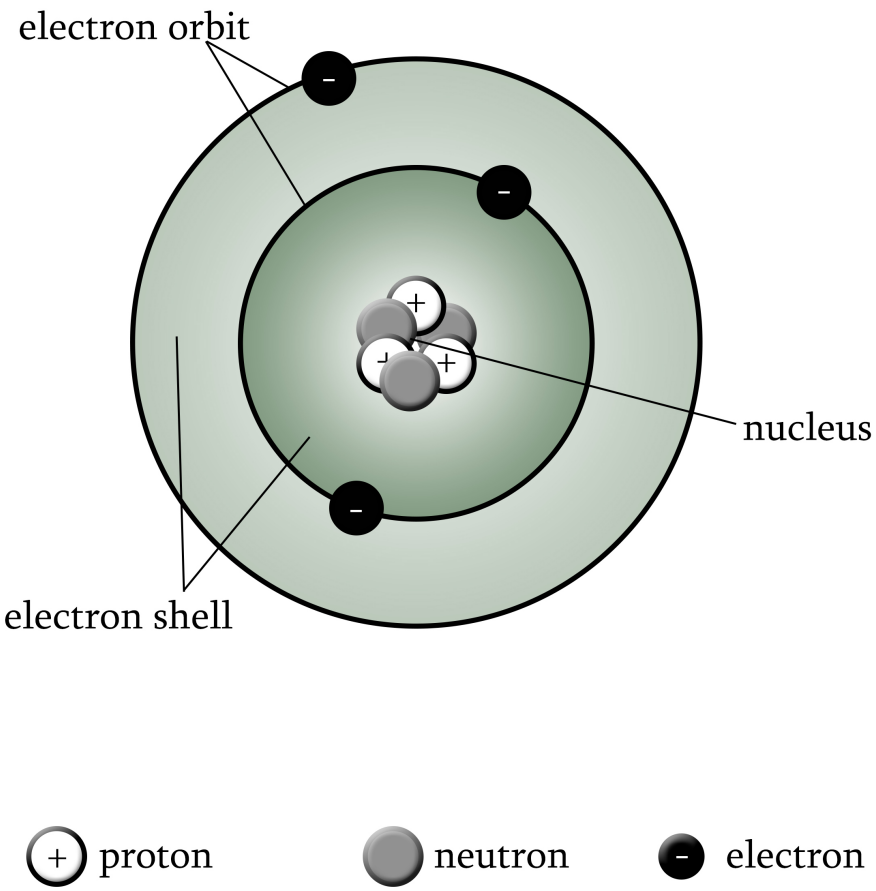
- **Make an atom –** Have the students make a model of an atom using pom-pom balls. They can

use red balls for protons (p), brown balls for neutrons (n) and yellow balls for electrons (e). Have them glue the protons and neutrons together for a nucleus. Then, glue the electrons onto yellow pipe cleaners and make a circle around the nucleus. Have the students try to make a model of helium (2p, 2n, 2e) or carbon (6p, 6n, 6e).

- **Atoms and Isotopes –** Have the students play an atoms and isotopes game. You can get directions for this game from the following blog post:
  - http://elementalscience.com/blogs/science-activities/60317571-free-chemistry-game

Sketch Week 1

Parts of an Atom



Student Assignment Sheet Week 2
Periodic Table

Research Report: Element Profile Page

This week you will spend time researching an element of your choice and creating a profile page for that element. Here is what you will do:

1. Begin by choosing one of the elements of the periodic table for an in-depth profile.
2. Do some research to find out more about your chosen element. Use the internet and the resources you have in your home or at your library to find out more about the element.
3. Answer the following questions from your research:
   - ✓ What is the name, symbol, atomic number and atomic mass of the element?
   - ✓ Who discovered the element and when did that happen?
   - ✓ Is it a gas, liquid or solid at room temperature?
   - ✓ Where is the element typically found?
   - ✓ What are the major uses of the element?

   Be sure to also write down any additional interesting facts you have learned on individual index cards.
4. Finally, complete the profile page for your element. Fill out the top left-hand rectangle with the information on the element from the periodic table. Then, answer the questions and write a brief summary on the element and its uses. You may also want to include the story of how the element was discovered in your summary.

Vocabulary & Memory Work

- ☐ Vocabulary: period, group, atomic number, atomic mass
- ☐ Memory Work—This week, add the following elements to what you are working on memorizing:
  - ✓ 5-B-Boron, 6-C-Carbon, 7-N-Nitrogen, 8-O-Oxygen

Sketch: The Periodic Table

- Label the following on the periodic table: periods 1-7, groups I-VIII, color the metals yellow, the metalloids green, and the nonmetals blue, plus add a key for the color-coding
- Label the following on the element call out box: atomic number, atomic mass, symbol, element name

Writing

- Reading Assignment: *Usborne Illustrated Dictionary of Science* pp. 164-165 (The Periodic Table)
- Additional Research Readings:
  - The Periodic Table: *USE* pp. 28-29, *KSE* pp. 152-153
  - The Elements: *USE* pp. 24-25, *KSE* pp. 148-149

Dates

- 1869 – Russian chemist Dmitri Mendeleyev draws up the very first periodic table, leaving gaps for elements that had not yet been discovered.

Schedules for Week 2

Two Days a Week

Day 1	Day 2
☐ Do the "Element Profile Page" Research Report on SG pp. 24-25 ☐ Define period, group, atomic number, and atomic mass on SG pg. 16 ☐ Enter the dates onto the date sheets on SG pp. 8-13	☐ Read pp. 164-165 from *UIDS,* then discuss what was read ☐ Color and label the "The Periodic Table" sketch on SG pg. 23 ☐ Prepare an outline or narrative summary, write it on SG pp. 26-27
Supplies I Need for the Week	
Things I Need to Prepare	

Five Days a Week

Day 1	Day 2	Day 3	Day 4	Day 5
☐ Do the "Element Profile Page" Research Report on SG pp. 24-25 ☐ Enter the dates onto the date sheets on SG pp. 8-13	☐ Read pp. 164-165 from *UIDS,* then discuss what was read ☐ Write an outline on SG pg. 26	☐ Define period, group, atomic number, and atomic mass on SG pg. 16 ☐ Color and label the "The Periodic Table" sketch on SG pg. 23	☐ Read one or all of the additional reading assignments ☐ Write a report from what you learned on SG pg. 27	☐ Complete one of the Want More Activities listed **OR** ☐ Study a scientist from the field of Chemistry
Supplies I Need for the Week				
Things I Need to Prepare				

Additional Information Week 2

Notes

- **Inner Transition Metals –** Elements 57 to 70 are also called Lanthanides, and elements 89 to 102 are also known as Actinides.
- **Superheavy Elements –** Elements that have an atomic number above 92 are known as superheavy or transuranium elements. These elements are extremely radioactive and have a very short half-life, which means that very few of these elements can actually be found in nature. Every one of these elements was first discovered in the lab. For the sake of simplicity, we will only refer to elements 104-118 as superheavy elements.
- **Discrepancies in the Periodic Table –** There are many different ways of informally grouping the elements as your students will see from the assigned and additional encyclopedia pages from this week. The periodic table can group the elements by type—metals, metalloids (or semi-metals), and nonmetals. It can group them according to orbitals—s-block, p-block, d-block, and f-block. Or it can group the elements informally—alkali metals, halogens, and so on. To learn more about why this is and download a colored versions of these tables, visit:
  - https://elementalscience.com/blogs/news/the-periodic-table

Experiment Information

- **Element Profile Page –** This week your students will be doing a mini-research report. They will be choosing an element from the periodic table to profile. All the instructions they need are on the Student Assignment Page, but they may need you to walk them through the process depending on how much experience they have with doing research prior to this assignment.

Discussion Questions

1. How are the elements on the periodic table organized? (*UIDS pg. 164 - The elements on the periodic table are arranged according their atomic number.*)
2. Who is credited with the basis of modern periodic table? (*UIDS pg. 164 - Dmitri Mendeleyev, a Russian chemist, is credited with the version of the periodic table that became the basis of the modern periodic table*.)
3. How does the periodic table work? (*UIDS pg. 164 - The periodic table has elements arranged horizontally in periods with increasing atomic mass. When you reach the end of a period it means that the element's outer electron shell is full*.)
4. What happens when you go across a period? (*UIDS pg. 164 - As you go across a period, the number of electrons increases by one*.)
5. What happens when you go down a group? (*UIDS pg. 165 - As you down a group on the periodic table the number of electron shells increases by one for each element.*)
6. What is the difference between metals, metalloids, and non-metals? (*UIDS pg. 165 - A metal has the metallic physical properties; these elements are solids, shiny, good conductors, and generally have high melting and boiling points. A nonmetal does not have these characteristics. Metalloids have some, but not all of these properties.*)

Want More

- **Wall Periodic Table –** Have your student make their own periodic table to display on the

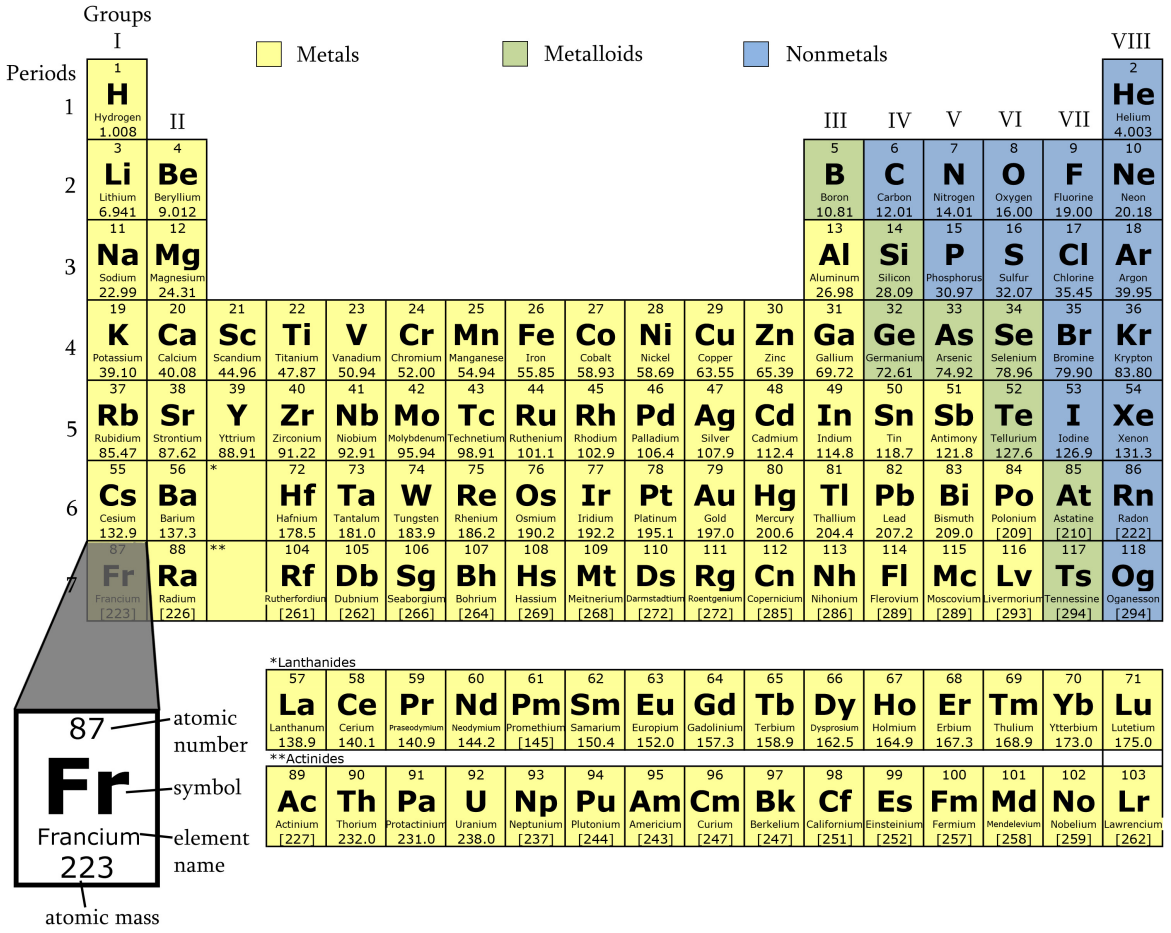
wall or purchase a visual representation of the periodic table from one of the following sites:

- http://elements.wlonk.com/ (*You can also download a 8 ½ by 11 pdf version for free.*)
- http://periodictable.com/ (*This is my personal favorite, but it is pricey.*)

I have also included a blank periodic table in the Appendix on pg. 271 that you could increase in size for your students to use on the wall.

Sketch Week 2

The Periodic Table of Elements



Chemistry for the Logic Stage Student Guide
Table of Contents

Chemistry for the Logic Stage
Letter to the Student

Dear Student,

Welcome to your journey through chemistry. Chemistry is the study the various forms of matter, their composition, structure, and properties, as well as how they react with each other. This year, you will examine atoms and molecules along with how they are related to the various forms of energy. You will look at the building blocks of chemistry, matter, solutions, mixtures, acids, and bases along your voyage. This guide is written for you, so enjoy your journey!

What this guide contains

First, this guide includes your date sheets and unit sheets. The unit sheets have your vocabulary words, weekly student assignment sheets, sketches, experiment sheets, and space for each of your writing assignments. After your unit sheets, you will find the Appendix. In it, you will find a list of all your memory work for the year, a glossary, and a place to record any additional activities you have done which pertain to chemistry.

Student Assignment Sheets Explained

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

- ✓ **Experiment —** Each week will revolve around a weekly topic. You will be assigned an experiment to complete 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. This is done through observation and experimentation. 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 keep you from repeating mistakes of 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 formulate a new hypothesis and begin the process again until they are able to 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 what the answer to the question posed in the lab is. In the procedure section you need to write step by step what you did during your experiment (so that someone else could read your report and replicate your experiment). In the observation section you need to write what you saw. Finally, in the conclusion section you need to write whether or not 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.

Vocabulary & Memory Work —Throughout the year, you will be assigned vocabulary and memory work for each unit. Each week, you will need to look up the word in your glossary and fill out the definitions on the Unit Vocabulary sheet found at the beginning of each unit in this guide. You may also want to make flash cards to help you work on memorizing these words. Each week, you will also have a memory work selection to work on. Simply repeat this 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. 253-255 of this guide.

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.

Writing — Each week, you will be writing an outline and/or a narrative summary. The student assignment page will give you a reading assignment for the topic from your spine texts, the *Usborne Science Encyclopedia* or the *Usborne Illustrated Dictionary of Science*. After you have finished the assignment, discuss what you have read with your teacher. Your teacher will let you know whether to write an outline or a narrative summary from your spine text reading. In addition to the two spines, your teacher may also assign additional research reading out of the following book:

The Kingfisher Science Encyclopedia, 2017 Edition (KSE)

Once you finish the additional reading, prepare a narrative summary about what you

have learned from your reading. Your outlines should be one-level main topic style outlines, and your narrative summaries should be one to three paragraphs in length, unless otherwise assigned by your teacher.

- **Dates** —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, 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 if you want you can draw a timeline in the space provided and enter your dates on that.

How to schedule this study

Chemistry for the Logic Stage is designed to take 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 day schedule:
  - **Day 1 —** Define the vocabulary, do the experiment and complete the experiment page, record the dates;
  - **Day 2 —** Read assigned pages and discuss together, prepare the science report or outline, complete the sketch.
- ✓ A typical five day schedule:
  - **Day 1 —** Do the experiment and complete the experiment page;
  - **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.

Final Thoughts

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

Sincerely,
Paige Hudson, BS Biochemistry, Author

Ancients 5000 BC–400 AD

Medieval-Early Renaissance 400AD-1600AD

Late Renaissance-Early Modern 1600 AD-1850 AD

Late Renaissance-Early Modern 1600 AD-1850 AD

Modern 1850 AD-Present

Modern 1850 AD-Present

Chemistry Unit 1

The Periodic Table

Unit 1: The Periodic Table
Vocabulary Sheet

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

1. Atom – _____

2. Electron Shell – _____

3. Element – _____

4. Compound – _____

5. Period – _____

6. Group – _____

7. Atomic Number – _____

8. Atomic Mass – _____

9. Metal – _____

10. Poor Metal – _____

11. Semimetal – _____

12. Malleable – _____

13. Semiconductor – _____

14. Nonmetal – _____

Student Assignment Sheet Week 1
Elements and Atoms

Experiment: Making Ice Cream

Materials:

- ✓ Heavy cream
- ✓ Milk
- ✓ Sugar
- ✓ Vanilla
- ✓ Crushed ice
- ✓ 1 small & 1 large zip-locking plastic bag
- ✓ Dish towel or oven mitt
- ✓ Rock salt

Procedure:

1. Mix together the ½ cup cream (120 mL), 1 cup milk (240 mL), ½ cup sugar (225 g) and 1 tsp vanilla (5 mL) in the small zip-locking plastic bag. Then, add the crushed ice and rock salt to the large zip-locking plastic bag. (***Note—****Make sure that the air is removed from both bags and they are sealed tightly.*)
2. Place the smaller bag with the cream mixture inside the larger bag with the ice. Cover the outside of the bag with the dish towel (or put on the oven mitt) and massage or shake the bag until the cream mixture has frozen. It should take about 5 to 10 minutes.
3. Take the smaller bag out of the larger bag, wipe off the salt water, open, eat and enjoy!

Vocabulary & Memory Work

- ☐ Vocabulary: atom, electron shell, element, compound
- ☐ Memory Work—This year you will be memorizing the elements that make up the periodic table, along with their atomic number and symbol. This week, work on the following elements:
  - ✓ 1-H-Hydrogen, 2-He-Helium, 3-Li-Lithium, 4-Be-Beryllium

Sketch: Parts of an Atom

- 🖼 Label the following: electron orbit, nucleus, electron shell, and the electron, proton, and neutron at the bottom of the page

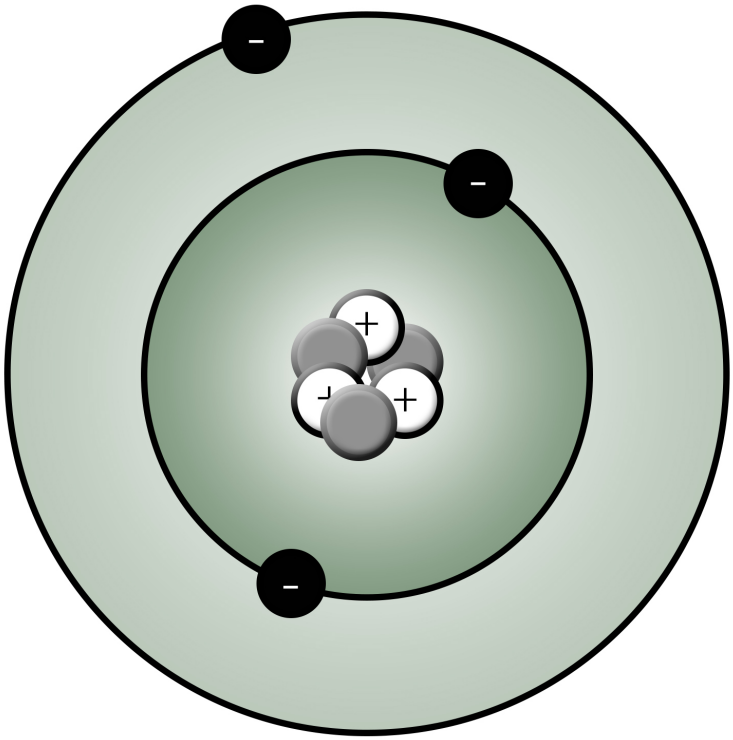
Writing

- ✍ Reading Assignment: *Usborne Illustrated Dictionary of Science* pp. 126-127 (Atomic Structure)
- ✍ Additional Research Readings:
  - 🕮 Atomic Structure: *USE* pg. 10-14
  - 🕮 Atoms: *KSE* pp. 150-151

Dates

- 🕒 340 BC – Aristotle proposes that all substances are made up of combinations of four elements: earth, air, water and fire.
- 🕒 1766-1844 – John Dalton lives. He is responsible for writing the first atomic theory.
- 🕒 1897 – J.J. Thompson discovers the electron.
- 🕒 1909 – Rutherford, along with two other scientists, discovers the nucleus of an atom.
- 🕒 1913 – Niels Bohr comes up with the Bohr model of an atom.

Sketch Week 1



Written Assignment Week 1

Discussion Questions

1. What is an atom?
2. What is the basic structure of an atom according to modern atomic theory?
3. What are the charges of the subatomic particles (i.e., protons, neutrons, and electrons)?
4. What is an electron shell?
5. What is an orbital?
6. What is an octet, and why is it important in chemistry?
7. What is the difference between atomic number and mass number?
8. What is an isotope?

Written Assignment Week 1

Student Assignment Sheet Week 2
Periodic Table

Research Report: Element Profile Page

This week you will spend time researching an element of your choice and creating a profile page for that element. Here is what you will do:

1. Begin by choosing one of the elements of the periodic table for an in-depth profile.
2. Do some research to find out more about your chosen element. Use the internet and the resources you have in your home or at your library to find out more about the element.
3. Answer the following questions from your research:
   - ✓ What is the name, symbol, atomic number and atomic mass of the element?
   - ✓ Who discovered the element and when did that happen?
   - ✓ Is it a gas, liquid or solid at room temperature?
   - ✓ Where is the element typically found?
   - ✓ What are the major uses of the element?

   Be sure to also write down any additional interesting facts you have learned on individual index cards.
4. Finally, complete the profile page for your element. Fill out the top left-hand rectangle with the information on the element from the periodic table. Then, answer the questions and write a brief summary on the element and its uses. You may also want to include the story of how the element was discovered in your summary.

Vocabulary & Memory Work

- ☐ Vocabulary: period, group, atomic number, atomic mass
- ☐ Memory Work—This week, add the following elements to what you are working on memorizing:
  - ✓ 5-B-Boron, 6-C-Carbon, 7-N-Nitrogen, 8-O-Oxygen

Sketch: The Periodic Table

- 🖼 Label the following on the periodic table: periods 1-7, groups I-XVIII, color the metals yellow, the metalloids green, and the nonmetals blue, plus add a key for the color-coding
- 🖼 Label the following on the element call out box: atomic number, atomic mass, symbol, element name

Writing

- ✍ Reading Assignment: *Usborne Illustrated Dictionary of Science* pp. 164-165 (The Periodic Table), *Kingfisher Science Encyclopedia* pp. 152-153 (The Periodic Table)
- ✍ Additional Research Readings:
  - 🕮 The Periodic Table: *USE* pp. 28-29, *KSE* pp. 152-153
  - 🕮 The Elements: *USE* pp. 24-25, *KSE* pp. 148-149

Dates

- 🕒 1869 – Russian chemist Dmitri Mendeleyev draws up the very first periodic table, leaving gaps for elements that had not yet been discovered.

Sketch Week 2

1																		2
H																		**He**
Hydrogen																		Helium
1.008																		4.003
3	4											5	6	7	8	9	10	
Li	**Be**											**B**	**C**	**N**	**O**	**F**	**Ne**	
Lithium	Beryllium											Boron	Carbon	Nitrogen	Oxygen	Fluorine	Neon	
6.941	9.012											10.81	12.01	14.01	16.00	19.00	20.18	
11	12											13	14	15	16	17	18	
Na	**Mg**											**Al**	**Si**	**P**	**S**	**Cl**	**Ar**	
Sodium	Magnesium											Aluminum	Silicon	Phosphorus	Sulfur	Chlorine	Argon	
22.99	24.31											26.98	28.09	30.97	32.07	35.45	39.95	
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	
K	**Ca**	**Sc**	**Ti**	**V**	**Cr**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**	**Ga**	**Ge**	**As**	**Se**	**Br**	**Kr**	
Potassium	Calcium	Scandium	Titanium	Vanadium	Chromium	Manganese	Iron	Cobalt	Nickel	Copper	Zinc	Gallium	Germanium	Arsenic	Selenium	Bromine	Krypton	
39.10	40.08	44.96	47.87	50.94	52.00	54.94	55.85	58.93	58.69	63.55	65.39	69.72	72.61	74.92	78.96	79.90	83.80	
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	
Rb	**Sr**	**Y**	**Zr**	**Nb**	**Mo**	**Tc**	**Ru**	**Rh**	**Pd**	**Ag**	**Cd**	**In**	**Sn**	**Sb**	**Te**	**I**	**Xe**	
Rubidium	Strontium	Yttrium	Zirconium	Niobium	Molybdenum	Technetium	Ruthenium	Rhodium	Palladium	Silver	Cadmium	Indium	Tin	Antimony	Tellurium	Iodine	Xenon	
85.47	87.62	88.91	91.22	92.91	95.94	98.91	101.1	102.9	106.4	107.9	112.4	114.8	118.7	121.8	127.6	126.9	131.3	
55	56	*	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	
Cs	**Ba**		**Hf**	**Ta**	**W**	**Re**	**Os**	**Ir**	**Pt**	**Au**	**Hg**	**Tl**	**Pb**	**Bi**	**Po**	**At**	**Rn**	
Cesium	Barium		Hafnium	Tantalum	Tungsten	Rhenium	Osmium	Iridium	Platinum	Gold	Mercury	Thallium	Lead	Bismuth	Polonium	Astatine	Radon	
132.9	137.3		178.5	181.0	183.9	186.2	190.2	192.2	195.1	197.0	200.6	204.4	207.2	209.0	[209]	[210]	[222]	
87	88	**	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	
Fr	**Ra**		**Rf**	**Db**	**Sg**	**Bh**	**Hs**	**Mt**	**Ds**	**Rg**	**Cn**	**Nh**	**Fl**	**Mc**	**Lv**	**Ts**	**Og**	
Francium	Radium		Rutherfordium	Dubnium	Seaborgium	Bohrium	Hassium	Meitnerium	Darmstadtium	Roentgenium	Copernicium	Nihonium	Flerovium	Moscovium	Livermorium	Tennessine	Oganesson	
[223]	[226]		[261]	[262]	[266]	[264]	[269]	[268]	[272]	[272]	[285]	[286]	[289]	[289]	[293]	[294]	[294]	

87
Fr
Francium
223

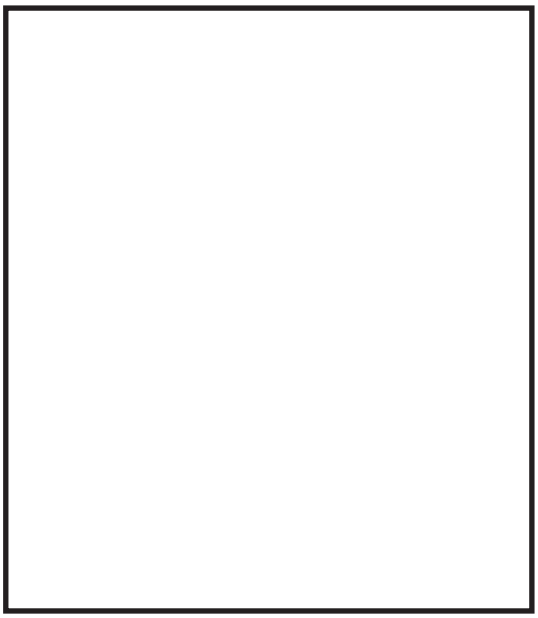
*Lanthanides

57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
La	**Ce**	**Pr**	**Nd**	**Pm**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**	**Ho**	**Er**	**Tm**	**Yb**	**Lu**
Lanthanum	Cerium	Praseodymium	Neodymium	Promethium	Samarium	Europium	Gadolinium	Terbium	Dysprosium	Holmium	Erbium	Thulium	Ytterbium	Lutetium
138.9	140.1	140.9	144.2	[145]	150.4	152.0	157.3	158.9	162.5	164.9	167.3	168.9	173.0	175.0

**Actinides

89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Ac	**Th**	**Pa**	**U**	**Np**	**Pu**	**Am**	**Cm**	**Bk**	**Cf**	**Es**	**Fm**	**Md**	**No**	**Lr**
Actinium	Thorium	Protactinium	Uranium	Neptunium	Plutonium	Americium	Curium	Berkelium	Californium	Einsteinium	Fermium	Mendelevium	Nobelium	Lawrencium
[227]	232.0	231.0	238.0	[237]	[244]	[243]	[247]	[247]	[251]	[252]	[257]	[258]	[259]	[262]

Element Profile Page



Discovered by: _____

Discovered in: _____

Common uses: _____

_____

_____

_____

Typically found in: _____

_____

Interesting Facts:

Written Assignment Week 2

Discussion Questions

1. How are the elements on the periodic table organized?
2. Who is credited with the basis of modern periodic table?
3. How does the periodic table work?
4. What happens when you go across a period?
5. What happens when you go down a group?
6. What is the difference between metals, metalloids, and non-metals?

Written Assignment Week 2

elemental science

Are you ready to start?

Learn about the periodic table, matter, solutions, chemical reactions, acids, bases, the chemistry of life, and the chemistry of industry by purchasing *Chemistry for the Logic Stage* here:

https://elementalscience.com/collections/chemistry-for-the-logic-stage

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