NOEO SCIENCE CHEMISTRY 2

INSTRUCTOR'S GUIDE

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noeo science
MOSCOW, IDAHO

Noeo Science Packages

GRADES 1–3 / AGES 5–8	GRADES 4–6 / AGES 9–12	GRADES 7–8 / AGES 12–15
Biology 1	Biology 2	Chemistry 3
Chemistry 1	Chemistry 2	Physics 3
Physics 1	Physics 2	

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Introduction: Welcome to Noeo

Welcome to Noeo Science! Thank you for trusting us to provide you with quality materials for teaching science at home. We understand that many homeschooling parents do not have a science background and may feel a bit intimidated about teaching science . . . especially when it comes to the experiments! Our books and experiments have been carefully selected to be of the highest quality available, yet simple enough for even the most science-phobic teachers and students. We intensely searched through library catalogs, websites, and hundreds of books before deciding on what we believe are the "best-of-the-best." We hope that you will agree and we're always open to your comments and suggestions.

Our Instructor's Guides provide a logical, focused progression through the books and experiments. Each week you will find an overview of what your student will learn as well as an answer key for the student lab manual reading and experiment questions. Multiple sources of information are used to teach each science topic. However, you won't need to spend your time searching for books or cross-checking indexes to make the curriculum flow. That work has been done for you!

The Noeo Method

You will find that the Noeo Science curriculum is different from all the rest. Each year of science will fill your child with wonder and excitement as they build a strong foundational knowledge of science. They'll be having so much fun that the learning will come naturally for them . . . and painlessly for you.

Noeo Science is variety-filled, with a structure that is best described as a balance between the classical method and the Charlotte Mason approach. We emphasize narration and summarization, vocabulary development, observation, and the scientific method. We do not promote rote memorization or tests, as we think that this approach is less valuable for long-term retention. The following table illustrates these characteristics:

TEACHING METHOD	CORRESPONDING NOEO SCIENCE CURRICULUM QUALITIES
Classical	• Emphasizes vocabulary development, especially in the younger years. • Develops critical thinking skills and logic through the use of the scientific method. • Incorporates the classical stages of learning, i.e., the Trivium (grammar, logic, and rhetoric).
Charlotte Mason	• Provides the best books available (including "living books"). • Utilizes a child's natural curiosity to acquire knowledge. "Studies serve for delight". • Uses narration and notebooks rather than worksheets, tests, or repetitive drills to evaluate learning.

We think it is important to learn science from a variety of sources, using a variety of teaching techniques. Our curriculum does not use the traditional, single textbook approach to science education. We think variety will encourage more interest in science, particularly with younger students. All of the books are carefully selected to allow children to discover the beauty, complexity, orderliness, and wonder of God's design. While some written work is expected, many hands-on activities are included within the bright, colorful, and well-written books. Living book biographies of many important scientists are included to provide a practical perspective.

Occasionally, a book may introduce a particularly secular viewpoint. We view these times as an opportunity for discussions and encourage you not to skip over or "cover up" this information. We do not provide "canned" answers for these discussions, but encourage instructors to study the issues for themselves and to pray for guidance and understanding in providing answers to each student's unique questions.

Just as creation is orderly and well organized, we think a good science curriculum should follow an orderly design. Each year of the curriculum will focus on biology, chemistry, or physics. Each of these three foundational sciences is studied independently for an entire year rather than jumping randomly from one subject to another without reason. The study of biology, chemistry, and physics is then repeated at a higher level and in more detail upon the completion of each three-year course of study (e.g. biology in 1st and 4th grade, chemistry in 2nd and 5th grade, etc.). Subjects that overlap multiple science disciplines, such as geology, weather, and astronomy,

are included at logical points within the three major science studies. For example, astronomy is studied in parallel with the study of gravity within the physics curriculum.

NOEO COURSE	APPROXIMATE AGES	GRADE EQUIVALENT	CLASSICAL TRIVIUM STAGE
Biology I Chemistry I Physics I	5–8	1–3	Early Grammar
Biology II Chemistry II Physics II	9–12	4–6	Late Grammar or Early Logic
Chemistry III Physics III	12–15	7–9	Late Logic or Early Rhetoric

Our curriculum is designed on a 4-day per week schedule. If you would prefer to do science twice weekly, then simply complete the first two days of scheduled readings and assignments on your first day, and the last two days of reading and assignments on your second day. Alternatively, you may wish to do all of the reading on the first day and the assignments and experiments on the second day. The key is to understand what works best for you and your children and to adjust the schedule as necessary.

The daily time necessary to complete the assignments will vary with individual student ability and will be based on the content being studied. We provide the following table as a guideline of the approximate time that you can expect to spend on daily assignments:

	4-DAY SCHEDULE	2-DAY SCHEDULE
Grades 1–3	15–20 minutes	30–40 minutes
Grades 4–6	20–30 minutes	40–60 minutes
Grades 7–9	30–40 minutes	60–80 minutes

Experiment Guide

Science is not a spectator sport. The best way for your child to learn and truly comprehend science is by doing hands-on experiments and activities. We know that this is one of the most dreaded parts of science for many homeschool families; that's why we were determined to put together high quality, straightforward experiments.

Noeo provides a strong foundation in science without wreaking havoc on your daily schedule. Each experiment and activity builds on the material that you cover in the week's readings, but don't worry–at the end of each experiment there is a section that explains what should have happened, and why it happened. So, if you decide to change things up, it won't be an issue.

The experiment kits come with any items that are normally difficult–or just plain inconvenient–to find. Both the Experiment Guide and Instructor's Manual have a complete supply list at the back, showing you which materials we're providing, and which materials you'll need from home. And yes, the home materials are real, honest-to-goodness, home materials–things for school, from your cabinets, and your pantry. Watch as your student progresses through these well organized, fully explained experiment kits, while actually having fun learning science.

You might notice that in between the Experiments there are some Activities and Optional Activities. Activities include the supplies you'll need, but they don't require as much explanation as Experiments, and your student won't be answering questions about them. Optional Activities are fun, optional things to do related to the reading of the week–most of the time they're outings or family activities, or they need materials that we didn't want to require you to buy.

Experiment Kits

There are 4 experiment kits, including all of the wild and wacky materials that you would normally spend hours (and let's face it: way too much money) sourcing on Amazon. Each kit lists its contents sorted by what you'll need for each week's experiments. Why 4 kits? It's much less overwhelming than opening a box full of loose food dye and pipettes. But there is an even better reason: say your child opens their Noeo box, and sees a toy car for an experiment 20 weeks away. Realistically, that car is toast. With the materials sorted into kits, the materials are a little easier to manage–and you only have a few weeks to make sure you don't lose that car, instead of 36.

Student Lab Manual

In the Student Lab Manual, your student will answer questions about key points both from their reading and experiments. The experiment questions in particular are centered around drawing results, making observations, asking questions, and making connections–all things that will slowly introduce your student to the scientific method and lab reports.

Younger students may need to "narrate" their descriptions and observations to you or an older sibling. It's completely up to you to determine the length and amount of detail you expect from your student, but we do encourage you to increase this expectation over time.

Instructor's Guide

Schedules, answers keys, lists of books and home supplies–it's all here. Everything you need to make Noeo work for you is right here in the Instructor's Guide. A list of the supplied books is provided, so that you can keep an eye on exactly which books you need for the course.

Lists of both home and included supplies are at the back of the book. The materials list is organized by weeks; so, if an experiment calls for a carrot, you won't be stuck with a slowly decomposing root vegetable in your fridge until you need it thirty weeks later.

Every week, you can refer to our provided schedule (flexible enough that you could do it all in 1 day if you've got an enthusiastic scientist, or stretch it out as much as you need), overview of the week's subject matter, and answers to both reading and experiment questions. If your student ends up begging to do more, no need to worry–you don't work for your curriculum, Noeo works for you.

Resource List

Books

- *DK Eyewitness: Chemistry,* by Dr. Ann Newmark
- *Explore Your World: Rocks and Minerals!*, by Cynthia Light Brown and Nick Brown
- *Fizz, Bubble & Flash*, by Anita Brandolini, PhD
- *The Mystery of the Periodic Table*, by Benjamin D. Wiker
- *Smithsonian Explanatorim of Science*, by DK
- *The Usborne Science Encyclopedia (internet-linked) Smithsonian Exploratorium of Science*, by DK

Experiment Kits

- *Noeo Experiment Kits 1-4*

DAILY LESSON PLANS FOR READING & EXPERIMENTS

unit 1: ATOMS AND MOLECULES

Week 1: The Parts of the Atom

Schedule

	DAY 1	DAY 2	DAY 3	DAY 4
The Usborne Science Encyclopedia			pp. 10–11 Optional: internet links on p. 11	
Explanatorium of Science	pp. 46–47			
DK Eyewitness Chemistry	p. 6	p. 7	p. 8	p. 9
Experiment Guide		Brownian Motion		Dancing Paper

Overview

Chemistry is about exploring matter itself, starting with the tiny building blocks that make up our world. Even though these building blocks are too small to look at, they explain how a lot of the things we see work. This is why we begin this unit of Chemistry with the basic building blocks of matter: atoms and molecules. You will be learning what the different parts of atoms are and how they are joined together through positive and negative charges. Remember, we study science in two ways: 1) by asking questions and testing possible answers (the scientific method), and 2) by reading about the work of other scientists who have followed the scientific method.

Reading Questions

DAY 1

1. What holds electrons in place in their shells? **The attraction to the protons in the nucleus of the atom holds electrons in their shells.**
2. What is Bohr's model? **Bohr's model is a model that shows electrons revolving around a nucleus in stable orbits.**
3. What is wrong with Bohr's model? **Its neat shells do not accurately show the paths of electrons. It would be more accurate to have a cloud.**
4. According to *DK Eyewitness Chemistry*, what is one of the largest industries in the world, and what is it associated with? **The petrochemical industry is one of the largest, and it is mainly associated with gasoline and the chemicals that come from crude oil.**

DAY 2

1. How is chemistry widely used in the food industry? **It is used to manufacture new convenient foodstuffs and to check for impurities.**
2. What is distillation? **It is a method of separating a mixture by boiling and condensing.**
3. Are all changes chemical? **No, when ice melts to form water, or water boils to form steam, no chemical reaction takes place, but the physical state changes.**

DAY 3

1. Sketch an atom. Label the nucleus, protons, neutrons, and the electron shells. Color the different parts, and label the correct electrical charge of each subatomic particle.
2. Use *The Usborne Science Encyclopedia* glossary to define atom. **An atom is a tiny particle from which elements are made. Each atom has a positively charged nucleus, balanced by enough negatively charged electrons to make the atom neutral.**
3. Define *electron*. **An electron is a negatively charged particle that exists around the nucleus of an atom.**
4. According to *DK Eyewitness Chemistry*, what is the thread of protein in a spider's web stronger than? **It is stronger than a thread of similar thickness made of steel.**

DAY 4

1. What do limestone rocks consist mainly of? **Limestone rocks consist mainly of calcium carbonate derived from the shells and skeletons of species such as shellfish.**
2. What do bacteria do in our intestines? **Bacteria break down some of the foods we eat, such as green vegetables and beans, into different nutrients.**
3. How does the chameleon alter the color of its skin to disguise itself from prey? **The chameleon has melanin-producing cells that can be activated by fear or anger; they disperse melanin granules to produce different colors that mask the chameleon's normal coloring.**

Experiment: Brownian Motion

MATERIALS

Included in Kit

- food coloring (save to use in future experiments)

From Home

- 2 clear glasses or jars
- hot and ice water

EXPERIMENT QUESTIONS

1. What is the movement of molecules called? **The movement of molecules is called Brownian motion.**
2. What is heat at a molecular level? **At a molecular level, heat is just molecules moving very quickly.**
3. Why did the cold water distribute the dye slower than the warm water? **The cold water distributed the dye slower than the warm water because the Brownian motion of cold water molecules is much slower than warm water molecules.**

Experiment: Dancing Paper

MATERIALS

From Home

- cereal box

- aluminum foil
- paper from a hole punch, or cut small bits of paper
- plastic wrap

EXPERIMENT QUESTIONS

1. What happened when you put the piece of plastic over the opening? **When you put the piece of plastic over the opening, the pieces of paper jumped up to stick to the plastic.**
2. How is static electricity caused? **Static electricity is caused by exchanging electrons.**
3. Are objects of opposite charges repelled by each other? **No, objects of opposite charges are attracted to each other.**

Week 2: How Molecules and Atoms Combine

Schedule

	DAY 1	DAY 2	DAY 3	DAY 4
The Usborne Science Encyclopedia		pp. 12–13 Optional: internet links on p. 13		pp. 14–15 Optional: internet links on p. 15
Explanatorium of Science			pp. 48–49	
DK Eyewitness Chemistry	p. 16	p. 17	p. 10	p. 11
Experiment Guide	Gas Underwater			

Overview

This week we will continue to picture how molecules and atoms combine. Although atoms are so small you can't see them with a light microscope, the different ways they combine change how the things you can see react with one another. You will also learn about chemistry in the ancient world.

Reading Questions

DAY 1

1. What did the Greek philosopher, Democritus, first suggest? **Democritus first suggested that matter is made of tiny indivisible particles.**
2. What did Amadeo Avogadro assert? **He asserted that the same volume of any gas would contain the same number of molecules.**

3. What did John Dalton believe about the atoms of an element? **He believed that the atoms of an element were all identical and differed from those of a different element.**

DAY 2

1. Use *The Usborne Science Encyclopedia* glossary to define atomic number. **The atomic number is the number of protons in the nucleus of an atom.**
2. Define *mass number*. **The mass number is the total number of protons and neutrons in the nucleus of an atom.**
3. Who first used the term "atom"? **The British chemist, John Dalton, first used it**
4. **when he put forward his atomic theory in 1807.**
5. According to *DK Eyewitness Chemistry*, what is used to help calculate how many atoms and molecules there are in a substance? **Avogadro's number is used as a constant.**

DAY 3

1. What are elements? **Elements are substances that cannot be broken down into simpler substances.**
2. What are the horizontal and vertical rows in the table called? **The horizontal rows are called periods and the vertical rows are called groups.**
3. What elements are human beings made up of? **We are mostly oxygen, with carbon, hydrogen, nitrogen, calcium, and phosphorus.**
4. According to *DK Eyewitness Chemistry*, what are some examples of how early people practiced chemistry in the ancient world? **People could cook food, bake clay into pottery, smelt ores to obtain metals, use yeast to make beer and wine, preserve foods, dye clothes, tan leather, make cosmetics, use glass as a glaze, blow glass into shapes, mummify the dead, and make lacquer, paper, and gunpowder.**

DAY 4

1. Where are atoms usually found? **They are rarely found on their own, but usually cling, or bond, together to form molecules.**
2. What does a chemical formula show? **A chemical formula shows the atoms of which a substance is made and in what proportions.**
3. Sketch a model of a water molecule. Color and label the parts.

4. According to *DK Eyewitness Chemistry*, what is tanning? **Tanning is a process which combines the skin with substances that preserve it as leather so that it remains flexible when dried.**

Experiment: Gas Underwater

MATERIALS

From Home

- clear glass or jar
- notebook paper
- container of water taller than the glass (bucket, tub, etc.)

EXPERIMENT QUESTIONS

1. What happened to the paper when you put the cup into the water? **When you put the cup into the water, the paper stayed dry!**
2. Why did that happen? **The paper did not get wet because the glass was full of air.**