

**NOEO
SCIENCE
CHEMISTRY 3
INSTRUCTOR'S GUIDE**

**NOEO
SCIENCE
CHEMISTRY 3
INSTRUCTOR'S GUIDE**

Created by Dr. Randy Pritchard

noeo science
MOSCOW, IDAHO

Noeo Science Packages

GRADES 1–3

Biology 1
Chemistry 1
Physics 1

GRADES 1–6

Biology 2
Chemistry 2
Physics 2

GRADES 7–8

Chemistry 3
Physics 3

Published by Noeo Science
PO Box 8729, Moscow, Idaho 83843
800-488-2034 | www.noeoscience.com
Email us at service@noeoscience.com

Randy Pritchard, *Noeo Science Chemistry 3 Instructor's Guide, 4th Edition*
Copyright ©2022 by Noeo Science
First edition 2005. Second edition 2015. Third edition 2021. Fourth Edition 2022.

Cover design & illustration by Forrest Dickison
Interior design by Valerie Anne Bost
Printed in the United States of America. All rights reserved.

Scripture taken from the NEW AMERICAN STANDARD BIBLE®, Copyright © 1960, 1962, 1963, 1968, 1971, 1972, 1973, 1975, 1977, 1995 by The Lockman Foundation. Used by permission.

All rights reserved. Unless otherwise noted, no part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form by any means, electronic, mechanical, photocopy, recording, or otherwise, without prior permission of the author, except as provided by USA copyright law.

Contents

Introduction

Welcome to Noeo	3
Resource List	7

Weekly Reading & Experiments

UNIT 1: ANCIENT CHEMISTRY

Week 1: Seven Ancient Metals	13
Week 2: The First Elements	15
Week 3: More Elements	17
Week 4: Early Discoveries	19
Week 5: What Is Chemistry?	21

UNIT 2: ATOMS AND ELEMENTS

Week 6: Measurements in Chemistry	25
Week 7: The Building Blocks of Everything	27
Week 8: The Periodic Table	29

UNIT 3: PHASES OF MATTER

Week 9: States of Matter – Liquids	33
Week 10: States of Matter – Gases	35
Week 11: Fresh Air for Our Lungs	37
Week 12: Changing States of Matter	39

UNIT 4: HOW CHEMICALS INTERACT

Week 13: Compounds, Mixtures, and Solutions	43
Week 14: Chemical Reactions	47
Week 15: More Chemical Reactions	49

UNIT 5: ACIDS AND BASES

Week 16: Distinguishing Acids and Bases	53
---	----

Week 17: Household Acids and Bases . . . . .	.55
Week 18: More Experiments with Acids and Bases . . . . .	.57

UNIT 6: OTHER ELEMENTS AND CHEMICALS

Week 19: Soap . . . . .	.61
Week 20: More Soap . . . . .	.65
Week 21: Carbon and Its Compounds . . . . .	.67
Week 22: Greenhouse Gas . . . . .	.69
Week 23: Sulfur Dioxide and Acid Rain . . . . .	.71
Week 24: The Nucleus and Radioactivity . . . . .	.73

UNIT 7: BRANCHES OF CHEMISTRY

Week 25: Electrochemistry and Organic Chemistry . . . . .	.77
Week 26: Rope and Fiber . . . . .	.79

UNIT 8: OTHER CHEMICALS

Week 27: Synthetics . . . . .	.83
Week 28: Silicon and Modern Metals . . . . .	.85
Week 29: Quicklime and Plaster . . . . .	.87
Week 30: Commercial Metals . . . . .	.89
Week 31: Copper . . . . .	.91
Week 32: Copper, Continued . . . . .	.93

UNIT 9: BIOCHEMISTRY

Week 33: The Chemistry of Living Things . . . . .	.97
Week 34: Sugar, Starch, and Glucose . . . . .	.99
Week 35: Chemistry and the Senses . . . . .	.101
Week 36: Your Own Chemistry . . . . .	.103

Lab Materials at Home . . . . .	.105
Additional Lab Materials . . . . .	.107

INTRODUCTION

What Does Noeo Mean?

noeo | (no eh' o) | verb

1. To perceive with the mind, to understand, to have understanding.
2. To think upon, heed, ponder, consider. (*The New Testament Greek Lexicon*)
3. Train the brain.

ROMANS 1: 20

For since the creation of the world His invisible attributes, His eternal power and divine nature, have been clearly seen, being **understood** through what has been made, so that they are without excuse.

noeo

The Noeo Philosophy

The essence of science is simply observing and describing God's creation. When scientists make a new discovery, they are seeing another part of creation revealed. Romans 1: 20 tells us that His attributes, power, and divine nature are clearly seen in what has been made.

While some scientists deny that their discoveries are evidence of God's creation, there are many that do recognize His attributes in all of creation. Our children should not be protected from science because of some scientific theories that deny God. They should instead be immersed in the sciences so that "His invisible attributes, His eternal power and divine nature" will be clearly seen.

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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 TRIV-IUM STAGE
Biology I Chemistry I Phys- ics 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

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
- *Exploring the World of Chemistry*, by John Tiner
- *Molecules: The Elements and the Architecture of Everything*, by Theodore Gray
- *Chemistry: Investigate the Matter That Makes Up Your World*, by Carla Mooney

Experiment Kits

- *Noeo Experiment Kit*
- CHEM C2000 – Thames & Kosmos (2016) English edition)

WARNING! The CHEM C2000 set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

NOTE: The Chem C2000 kit must be used under adult supervision. Please read the cover, inside front cover, pages 1–15 and 123–124, and complete experiments 1 and 2 in the Chem C2000 Experiment Manual prior to beginning any other experiments contained in this kit.

**WEEKLY READING
& EXPERIMENTS**



unit 1:
A N C I E N T
C H E M I S T R Y

Week 1: Seven Ancient Metals	13
Week 2: The First Elements	15
Week 3: More Elements	17
Week 4: Early Discoveries	19
Week 5: What Is Chemistry?	21



Week 1: Seven Ancient Metals

Schedule

	DAY 1	DAY 2	DAY 3	DAY 4
<i>Exploring the World of Chemistry</i>	Chapter 1, Ancient Metals, pp. 4-10	Chapter 1 Questions, p. 11	Chapter 2, The Money Metals, pp. 12-16	Chapter 2 Questions, p. 17

Overview

Chemistry is not just something that started a couple of centuries ago when men began putting things in tubes and experimenting on them. The first act of chemistry was whenever someone first baked something. Chemistry is simply the study of the physical world and what it is made of.

Nowadays we know a lot more about the tiny things that make up our world, but scientists have been playing with metals for thousands of years. As you go through this year, you will learn about the science of chemistry and how elements combine to make up our world.

Remember that science can refer to two things: 1) science is the process we use to answer questions about the physical world we see around us (testing with experiments), and 2) science is the body of knowledge other people (scientists) have collected by using the scientific process (or scientific method).

Reading Questions

DAY 1

1. Where did ancient civilizations get their iron from? **They got it from rocks falling from the sky (meteorites).**
2. What is the most useful and strongest form of iron? **Steel is the most useful and strongest form of iron.**

3. How does tin protect food? **A thin layer of tin is plated over a steel can; it is non-toxic and does not discolor food.**
4. What can we easily do with lead? **We can easily work it into sheets and roll it into pipes.**

DAY 2

1. Use this space to answer the questions on p. 11 of *Exploring the World of Chemistry*.
(12 questions)

DAY 3

1. What is gold mixed with and why? **Gold is mixed with copper to make it harder and longer-lasting.**
2. Why is the Statue of Liberty blue-green? **The Statue of Liberty has a copper skin, and copper slowly turns green as it combines with sulfur compounds in the air.**
3. What is copper mostly used for today? **Copper is used for electric wires.**
4. What instruments is mercury the main component of? **Mercury is the main component of barometers, thermometers, and electric switches.**

DAY 4

1. Use this space to answer the questions on p. 17 of *Exploring the World of Chemistry*.
(15 questions)



Week 2: The First Elements

Schedule

	DAY 1	DAY 2	DAY 3	DAY 4
<i>Exploring the World of Chemistry</i>	Chapter 3, The Search for Gold, pp. 18-26	Chapter 3 Questions, p. 27	Chapter 4, Gases in the Air, pp. 28-34	Chapter 4 Questions, p. 35

Overview

This week you get to learn about the discovery of the first element. We all know that everything is made of atoms and molecules, but certain molecules take specific shapes, and these are known as elements and they are the basic tools of chemistry.

Reading Questions

DAY 1

1. What were the two non-metallic elements of the ancient world? **The two non-metallic elements were carbon and sulfur.**
2. What did alchemists think that all nature was made of? **They believed that everything contained some of the four elements – earth, water, air, and fire.**
3. How did Robert Boyle define an element? **A chemical element was a pure substance that could not be separated into simpler substances by chemical action.**
4. What new element did Robert Boyle discover, and what did it do? **He discovered phosphorous which glowed in the dark and burst into flames when rubbed.**

DAY 2

1. Use this space to answer the questions on p. 27 of *Exploring the World of Chemistry*. (17 questions)

DAY 3

1. What gas did Henry Cavendish discover? **Henry Cavendish discovered hydrogen.**
2. What does oxygen make up? **Oxygen makes up more than half of the earth's crust, slightly more than one-fifth of the atmosphere, and two-thirds of the human body.**
3. What does nitrogen do in our atmosphere, and what does it make possible? **Nitrogen helps control combustion and makes open flames possible.**
4. What are two important uses of nitrogen? **Two important uses of nitrogen are in explosives and fertilizer.**

DAY 4

1. Use this space to answer the questions on p. 35 of *Exploring the World of Chemistry*.
(16 questions)