NOEO SCIENCE PHYSICS 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 12–14
Biology 1	Biology 2	Chemistry 3
Chemistry 1	Chemistry 2	Physics 3
Physics 1	Physics 2	

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INTRODUCTION

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 and complexity of nature. 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 viewpoint you may not agree with. 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 to provide answers to each student’s unique questions.

Just as nature is orderly, 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	6–8	1–3	Early Grammar
Biology II Chemistry II Physics II	9–11	4–6	Late Grammar or Early Logic
Chemistry III Physics III	12–14	7–8	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 7–8	30–40 minutes	60–80 minutes

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

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, but 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 Student Lab Manual 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.

Each week, 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 Guides

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

- *Along Came Galileo*, by Jeanne Bendick
- *Archimedes and the Door of Science*, by Jeanne Bendick
- *Gizmos and Gadgets*, by Jill Frankel Hauser
- *Smithsonian Explanatorium of Science*, by DK
- *The Usborne Science Encyclopedia (Internet-Linked)*

Experiment Kits

- *Noeo Experiment Kits 1-4*

DAILY LESSON PLANS FOR READING & EXPERIMENTS

unit 1:

ENERGY

Week 1: What Makes Things Change

Schedule

	DAY 1	DAY 2	DAY 3	DAY 4
The Usborne Science Encyclopedia		pp. 106–107 Optional internet links on p. 107	pp. 108–109 Optional internet links on p. 109	
Explanatorium of Science	pp. 126–127			
Gizmos and Gadgets				pp. 111–117
Lab Manual Experiment	Circular Motion	Matchbox Boat		Merry-Go-Round; Rubber Band Racer

Overview

Physics is the science of how things move and change. If you drop a piece of paper and a block, why does one of them hit the ground first? What makes a bike stop when you press on the brake? Why does fire ignite, and what makes it die out? All of these questions are physics questions. Think about *how* things move. Whenever something is moving or changing, it needs energy. As you go through this week, you will learn about how energy works, how we measure it, and how it changes.

Reading & Experiment Questions

DAY 1

1. What energy does a rollercoaster carriage have stored at the top of a loop? **The rollercoaster has gravitational potential energy stored.**

2. Where is gravitational energy stored? **Gravitational energy is stored by anything raised above the Earth's surface that will fall to the earth once it's let go.**
3. Where is elastic energy stored? **Elastic energy is stored in things that are stretched, and will snap back into their original shape when they're let go–like a spring.**

Experiment: Circular Motion

MATERIALS

Included in Kit

- string (22 inches)

From Home

- copy paper
- tape
- something weighted, like a marble or small toy

EXPERIMENT QUESTIONS

1. What happened when you swung the small, weighted object? **It swung in a uniform circular motion.**
2. What is increased acceleration toward the center of a circle called? **It is called centripetal acceleration.**

DAY 2

1. What are the four forms of energy you learned about in today's reading? **The four forms are chemical energy, potential energy, electrical energy, and kinetic energy.**
2. Sketch an example of something that uses one of these forms of energy, and label which form of energy it uses.
3. What is the law of the conservation of energy? **Energy can never be created or destroyed. Energy is simply converted into a different form.**

Experiment: Matchbox Boat

MATERIALS

Included in Kit

- rubber band

From Home

- matchbox

- cardboard
- bowl or tub of water

EXPERIMENT QUESTIONS

1. What type of energy did the twisted rubber band represent? **The twisted rubber band represented potential energy.**
2. What type of energy did you harness when you released the rubber bands, and your contraption rolled away? **When your contraption rolled away, it was using kinetic energy.**

DAY 3

1. Use *The Usborne Science Encyclopedia* glossary to define *fossil fuels*. **They are fuels such as coal, oil, and natural gas that are formed from the fossilized remains of plants or animals.**
2. Define *joules*. **Joules are the SI (or metric) unit of energy and work.**
3. Define *power*. **Power is the rate that work is done or energy is used, measured in watts (W).**
4. Define *watts*. **Watts are the SI (or metric) unit of power.**

DAY 4

1. What is potential energy? **Potential energy is energy that is stored in something and ready to be used.**
2. What is one of the examples from the reading of something with potential energy? Why does that thing have potential energy? **Examples range from a rock at the top of a mountain to a stretched slingshot to a match. All of these things are capable of using a form of energy.**
3. Define *kinetic energy*. **It is the energy of a moving object.**

Optional Activity: Merry-Go-Round

MATERIALS

From Home

- plastic soda bottle, with cap
- 2 or 3 rubber bands
- plastic straw
- tape

- paperclip
- washer
- pencil or chopstick
- dried beans
- paper
- scissors
- thread

Activity: Rubber Band Racer

MATERIALS

Included in Kit

- 2 rubber bands
- paper clip

From Home

- soup can, opened at both ends
- 2 DVDs (if you would rather not ruin some old DVDs, trace DVDs onto cardboard and cut them out)
- duct tape
- pencil
- scissors
- washer, optional

Week 2: How We Use Energy

Schedule

	DAY 1	DAY 2	DAY 3	DAY 4
Gizmos and Gadgets	pp. 118–123	pp. 124–127	pp. 128–131	pp. 132–136
Lab Manual Experiment	Scary Surprises		Knock It Off!	Pinwheel Power

Overview

As we learn about energy, it is easy to think of energy as something in books instead of something that we are using all the time. You are using it to read these words, and as you turn the pages of this book. This week we will learn about some interesting discoveries about energy, and you will also begin to perform some experiments! Remember that an experiment is how we test our hypothesis (guess) that we have about something we observe. This is the scientific method.

Reading & Experiment Questions

DAY 1

1. What discovery got scientists on track to invent batteries? **A scientist touched two different metals to a frog leg, and it twitched! He thought that meant the frog leg had electricity in it, but it turned out that it was actually the metals!**
2. Who invented the first battery? **Alessandro Volta invented the first battery.**
3. How does a trampoline bounce you so high? **When you bounce on a trampoline, its stretchy material bends out of shape, so when it goes back to its original shape, that bounces you up!**

Activity: Scary Surprises

MATERIALS

Included in Kit

- 2 rubber bands

From Home

- small cardboard box (a toaster pastry box would work very well)
- scissors
- construction paper, optional
- glue

DAY 2

1. What is an everyday example of a pendulum that you might see at the playground? **A swing is an example.**
2. Why does a swing eventually stop swinging if you don't pump your legs? **The swing eventually stops because of the forces of gravity and friction slowing it down.**
3. What was Galileo's discovery? **He saw a swinging lamp and even though each swing was shorter than the last, each took the same length of time.**

DAY 3

1. Energy can change forms and be transferred, but what about it can never change? **The amount of energy can never change–it can never be created or destroyed.**
2. Why would a marble bumping into a line of marbles cause the marble at the front of the line to roll away? **The rolling marble's energy was transferred through the line to the marble at the front.**
3. What is this idea called? **This idea is the conservation of energy**.
4. Why are waves near the shore bigger than the waves further out in the water? **The waves near the shore are bigger because they have the same amount of energy as waves out in the water, but not as much water to push on.**

Experiment: Knock It Off!

MATERIALS

Included in Kit

- 6 marbles (save for future experiments)

From Home

- egg carton
- lid (could be from a milk carton or orange juice jug; anything with pretty high walls.)
- scissors
- tape

EXPERIMENT QUESTIONS

1. What is the law of the conservation of energy? **The conservation of energy is the idea that energy cannot be created or destroyed, only transformed or transferred.**
2. What happened when the rolling marble bumped into the line of stationary marbles? **When the rolling marble bumped into the line of stationary marbles, the marble at the end of the line rolled away!**
3. Why did that happen? **The marble at the end of the line began to move because the rolling marble transferred its energy all the way through the line! The marble at the end of the line received its energy, and began rolling.**

DAY 4

1. What initially prevented Thomas Edison from inventing the lightbulb? **He could not find a fiber that wouldn't burn up inside of the bulb.**
2. Why wasn't Edison discouraged when he had tested 300 fibers with no success? **He wasn't discouraged because now he knew the 300 fibers that *didn't* work!**

Experiment: Pinwheel Power

MATERIALS

Included in Kit

- construction paper
- jumbo paperclip
- cork
- plastic straw

From Home

- scissors
- tape
- cracker or snack box
- glue
- hole punch

EXPERIMENT QUESTIONS

1. What type of energy does moving air have? **Moving air has kinetic energy.**
2. What is another name for the energy that wind has? **Wind energy.**
3. How does a pinwheel start to move? **The pinwheel catches moving air, and harnesses its kinetic energy to cause the wheel to spin.**