

PHYSICS III: It's FORCEful!

INSTRUCTOR'S GUIDE

Dr. Randy Pritchard

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.
(Source: The New Testament Greek Lexicon)
3. Train the brain.
(Source: our 8 year-old son)

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

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. +

Welcome

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 experiment kits 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. 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!

Our 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.

Understanding the Noeo Science Curriculum

You will find that the Noeo Homeschool Science curriculum is different from any other that is available. 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 Homeschool 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 the worksheet and test methodology, as we think that this approach is less valuable for long-term retention. The following table illustrates these characteristics:

<u>Teaching Method</u>	<u>Corresponding Noeo Science Curriculum Qualities:</u>
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. Optional Internet references are also provided throughout the curriculum.

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 instructor's 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.

	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
Biology III 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 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

The Science and Lab Notebooks

We provide reproducible sheets for creating science and lab notebooks for use with the Noeo Science curriculum. The notebooks are an integral part of the curriculum. Feel free to modify these sheets and to tailor your expectations for each child.

Your student will be asked to describe, sketch or summarize what they learn from the reading assignments, or to complete a lab sheet for their experiments. This method will encourage concentration and attention to detail. In addition, the lab sheets are designed to help your student to apply the scientific method in all of their experiments.

Younger students may need to “narrate” their descriptions and observations to you or an older sibling. You will need to determine the length and amount of detail that your student is capable of. We encourage you to increase this expectation over the course of time.

Science Experiments

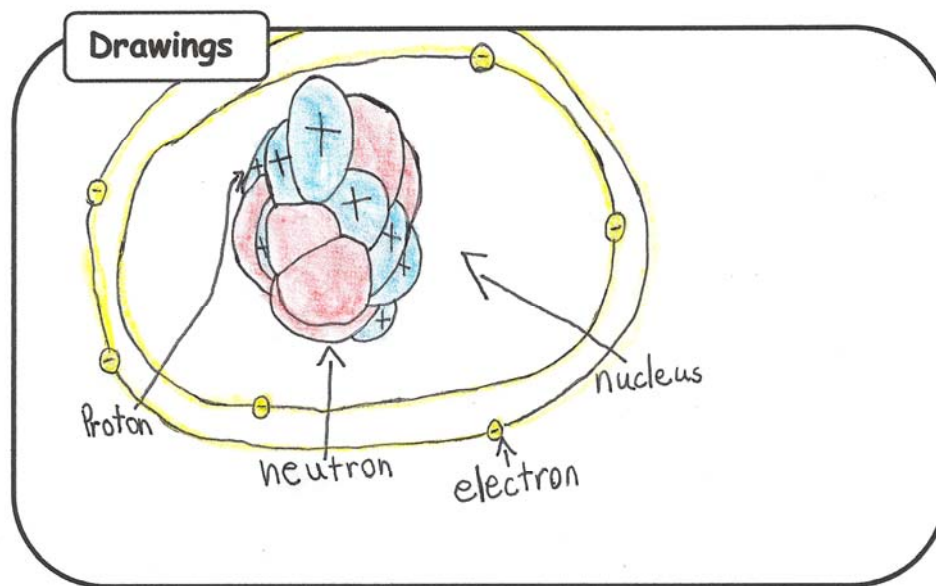
Science is not a spectator sport. The best way for your child to learn and truly comprehend science is by doing hands-on experiments and activities. We understand that this is probably the most difficult part of science for many homeschool families. That is why we were determined to find sources of high quality, yet simple, experiments.

We are pleased to say that the experiments in our curriculum will provide a strong science foundation without wreaking havoc on your daily schedule. For example, many of our experiments are provided through a unique arrangement with *The Young Scientists Club*. These experiment kits come complete with all of

the items that are normally difficult to find. They have won multiple awards for their high quality and have become increasingly popular among homeschoolers in recent years. We think you will be pleasantly surprised as your child progresses through these well organized, fully explained experiment kits while actually having fun learning science.

Our other experiments and activities are also carefully selected to provide relevant and interesting examples of the topics being studied. We provide a supply list for each week of the year, along with a “Master Supply List” at the beginning of the Instructor’s Guide. You’ll notice that most, if not all, of the items on this list can already be found in your home (honest!).

The following pages are samples copied from a science notebook of a nine-year-old that is using our Chemistry II course. Younger students would orally "narrate" their summaries to an older sibling or adult. Older children should be expected to provide more detailed narrations (summarizations). It is not necessary to complete an experiment sheet for every experiment, especially with younger students. However, it is good to complete them often in order to establish a strong understanding of the scientific method.



Reading Notes

Atoms are made up of: electrons, neutrons, and protons.
Atoms are tiny particles of what everything is made.

Definitions

nucleus- The core section of an atom that contains protons and neutrons.

neutron- a subatomic particle with no electrical charge in the nucleus of an atom.

Proton- a positively charged subatomic particle in the nucleus of an atom.

electron shells- an energy level around the nucleus.

Date 2/2/06

Experiment Name A feast for Yeast

What have you learned about this subject?
(observation/research)

That yeast is alive!

What question are you trying to answer?
(question)

What happens when you feed sugar to yeast?

What things do you need?
(materials)

1. a bottle
2. yeast
3. sugar
4. warm water
5. a balloon
6. _____
7. _____
8. _____

What will you do to answer the question? (experiment/test)

put yeast in a bottle, put in sugar and put a balloon over it.

What do you think will happen? (hypothesis/prediction)

the balloon will blow up with CO₂ that the yeast makes

What happened? (results)

the balloon inflated.

Why do you think this happened? (conclusion)

The balloon catches the CO₂.

© 2006 Noeo Science Curriculum, Ltd. All rights reserved. www.noeoscience.com
This page may be reproduced for use with Noeo Science curriculum.

Reproducible Pages

Science Notebook Pages Lab Notebook Pages

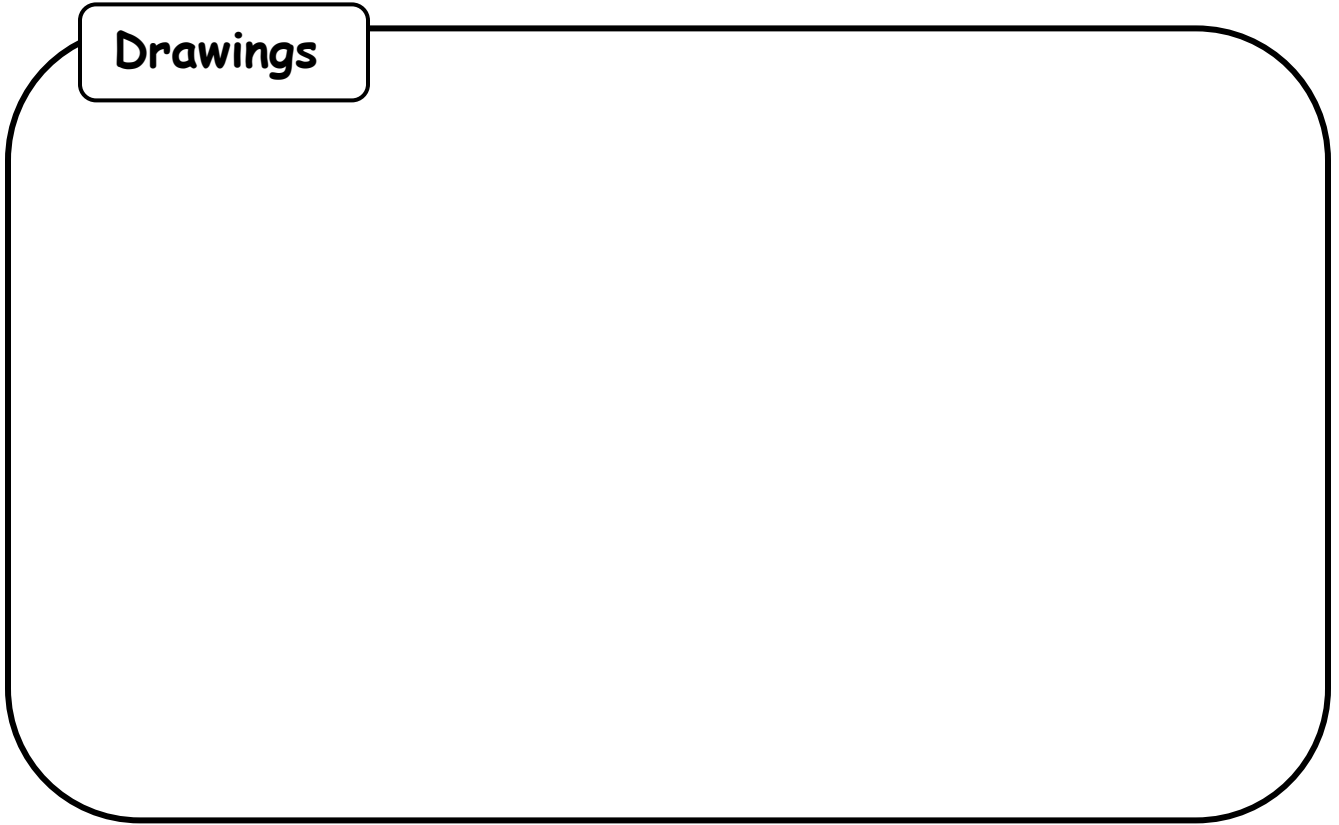
The following pages are provided for your convenience. They may also be found on our website (www.noeoscience.com) for free downloading and printing. New pages will also be added occasionally on the website. There are a variety of page styles to be used for notebook creation. Some contain a space for drawing *and* writing; others have space only for drawing *or* writing. Different line spacing options are also provided for young writers. Feel free to make as many copies as you need.

Please remember that younger students should begin by orally “telling back” what they have just learned. You may prefer to write their thoughts down in a notebook for them.

As they become better writers, then begin to have them write a sentence or two. Increase your expectations over time until you can find a balance between the student’s love for learning and their need for applied narration.

The lab notebook pages (experiment page) are intended to be used as a tool for teaching the scientific method. Again, younger students should not be expected to complete this sheet without assistance. Begin by orally asking some of the questions on the sheet after completing an experiment. Progressively increase your expectations for the completion of the experiment sheet. Older students should eventually be able to write a complete lab report without the need for this sheet.

Drawings



Reading Notes

Definitions

Date _____

Experiment Name _____

What have you learned about this subject?
(observation/research)

What question are you trying to answer?
(question)

What things do you need?
(materials)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

What will you do to answer the question? (experiment/test)

What do you think will happen? (hypothesis/prediction)

What happened? (results)

Why do you think this happened? (conclusion)

Date _____

Experiment Name _____

Observation/Research

Question

Materials

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Experiment/Test

Hypothesis/Prediction

Results

Conclusion

**Weekly
Reading and Assignment
Schedule**

noeo science

PHYSICS 3

Book List

Exploring the World of Physics, John Hudson Tiner

Isaac Newton, by Mitch Stokes, Christian Encounter Series

Introduction to Physics: The Science of Physics, Andrea R. Field, ed.

Introduction to Physics: Energy, Andrea R. Field, ed.

Introduction to Physics: Sound, Sherman Hollar, ed.

Physical Science in Depth: Light, by Alfred J. Smuskiewicz

DK Eyewitness: Electricity, by Steve Parker

Physics: Why Matter Matters!, by Dan Green, Basher Science

Experiment Kit

Thames and Kosmos - Physics Workshop

Electronic Snap Circuits - Snaptricity

noeo science

PHYSICS 3

The following is a complete list of items that will be used for the required experiments over the entire 36-week course. This list includes many items that are common in most homes. The list does not include the items that are provided in *Thames and Kosmos Physics Workshop* kit.

Master Supply List	
Item needed:	Week(s) used:
Dime	3
Quarter	3
Wooden matchstick	4
Raw potatoes (2)	4
Thread	4
Stopwatch (or watch with a second hand)	6
Tape measure or ruler	6, 7
Protractor	8
Piece of paper	8
C-type battery	9
Small (16 oz.) water bottle	10, 13
Pencil	11
Wooden board or similar object	11
Paper clips	12
Piece of string or dental floss	12
AA batteries (3) for Snaptricity set	17
Wool item	17
Balloon	17, 33
Comb	17
Lemon (or tomato, or grapefruit)	17
Salt	17, 20
Fruit juice	17
Cola	17
Cup or bowl	20, 32
Coin	32
Rubber bands	34
Ruler	34
Rectangular (shoe) box	34

noeo science

PHYSICS 3

Weekly Schedule	
Week 1	An Overview of Physics
Week 2	An Overview of Physics
Week 3	Forces and Motion
Week 4	Forces and Motion
Week 5	Forces and Motion
Week 6	Forces and Motion
Week 7	Forces and Motion
Week 8	Forces and Motion
Week 9	Forces and Motion; Simple Machines
Week 10	Simple Machines
Week 11	Simple Machines
Week 12	Energy
Week 13	Energy
Week 14	Energy
Week 15	Energy
Week 16	Energy
Week 17	Electricity
Week 18	Electricity
Week 19	Electricity
Week 20	Electricity
Week 21	Electricity
Week 22	Electricity
Week 23	Electricity
Week 24	Magnets and Electromagnetism
Week 25	Magnets and Electromagnetism
Week 26	Magnets and Electromagnetism
Week 27	Magnets and Electromagnetism
Week 28	Magnets and Electromagnetism
Week 29	Magnets and Electromagnetism
Week 30	Light
Week 31	Light
Week 32	Light
Week 33	States of Matter
Week 34	Sound
Week 35	Sound; Nuclear Energy
Week 36	Future Physics

noeo science

PHYSICS 3

Week 1 - An Overview of Physics				
	Day 1	Day 2	Day 3	Day 4
Introduction to Science: THE SCIENCE OF PHYSICS	Pp. 6-9	Pp. 10-16	Pp. 17-23	Pp. 24-35

Supply List: none

Assignments:

Read the assigned pages and/or complete the experiment(s). In your own words, describe what you have learned. Use the reproducible sheets to create a science notebook for writing/sketching important ideas. At a *minimum*, be sure to report on the “**Keys to Understanding**” items below. Use the reproducible experiment pages to document your laboratory exercises.

Keys to Understanding:

Day 1 – BEFORE you read today’s assignment, write everything a summary of what you already know about physics.

Day 2 – Describe the major branches of physics and some of the main scientists in this field of study and a brief summary of their contributions.

Day 3 – Trace the history of man’s understanding of physics.

Day 4 – Explain Galileo and Isaac Newton’s contribution to mechanics.

Define: mechanics, force

noeo science

PHYSICS 3

Week 2 – An Overview of Physics				
	Day 1	Day 2	Day 3	Day 4
Introduction to Science: THE SCIENCE OF PHYSICS	Pp. 36-44	Pp. 45-51	Pp. 52-59	Pp. 60-71
Physics: Why Matter Matters!	Pp. 4, 6			
Isaac Newton, by Mitch Stokes	Chap. 1 (pp. 1-15)	Chap. 2 (pp. 16-25)	Chap. 3 & 4 (pp. 26-40)	Chap. 5 (pp. 41-54)

Supply List: none

Assignments:

Read the assigned pages and/or complete the experiment(s). In your own words, describe what you have learned. Use the reproducible sheets to create a science notebook for writing/sketching important ideas. At a *minimum*, be sure to report on the “**Keys to Understanding**” items below. Use the reproducible experiment pages to document your laboratory exercises.

Keys to Understanding:

Day 1 – Explain Einstein’s concept of special relativity. Why was this significant? Also explain Einstein’s general theory of relativity and its significance.

Day 2 – Explain the kinetic molecular theory. What was Max Planck’s contribution to this theory?

Day 3 – What is the relationship of light and electricity? Define, in your own words, **electromagnetism**.

Day 4 – What is wave theory? What is particle theory? Explain the nature of electricity and the atom. **Define: quantum mechanics.**

noeo science

PHYSICS 3

Week 3 – Forces and Motion				
	Day 1	Day 2	Day 3	Day 4
Exploring the World of Physics	Pg. 6	Pp. 4, 5, 7 (the first four paragraphs, through "...30 years after Galileo died.")	Pp. 7b – 10 (almost the entire page, through the paragraph that ends "They are multiplied together.")	10b-13
Isaac Newton, by Mitch Stokes	Chap. 6 (pp. 55-67)	Chap. 7 (pp. 68-80)	Chap. 8 & 9 (pp. 81-103)	Chap. 10 (pp. 104-114)

Supply List: dime, quarter

Assignments:

Read the assigned pages and/or complete the experiment(s). In your own words, describe what you have learned. Use the reproducible sheets to create a science notebook for writing/sketching important ideas. At a *minimum*, be sure to report on the "Keys to Understanding" items below. Use the reproducible experiment pages to document your laboratory exercises.

Keys to Understanding:

Day 1 – Why would the study of physics include a discussion on Aristotle?

Day 2 - What discovery helps clocks keep better time?

Day 3 – How did Galileo slow the motion of falling balls? Try the "Falling Objects" experiment on pg. 7. Then summarize Galileo's experiment with steel balls and a ramp. What was he trying to prove, and what did he learn?

Day 4 – What is Galileo's legacy? Answer the questions, reviewing those areas in which you might not be sure. Check your answers with the key on p. 155.

noeo science

PHYSICS 3

Week 4 - Forces and Motion				
	Day 1	Day 2	Day 3	Day 4
Physics Workshop Experiment Manual	Pp. 3-6 (and inside front cover)	Pp. 7-9 Stop at the end of "Weightless"		
Isaac Newton, by Mitch Stokes	Chap. 11 & 12 (pp. 115-132)	Chap. 13 (pp. 133-144)	Chap. 14, 15 & Epilogue (pp. 145-168)	(see below)

Supply List: Physics Workshop experiment kit

Assignments:

Read the assigned pages and/or complete the experiment(s). In your own words, describe what you have learned. Use the reproducible sheets to create a science notebook for writing/sketching important ideas. At a *minimum*, be sure to report on the "**Keys to Understanding**" items below. Use the reproducible experiment pages to document your laboratory exercises.

Keys to Understanding:

Day 1 – Spend a little time getting familiar with the Physics Workshop kit contents, warnings, and directions.

Day 2 – Build the Potato Trap in Workshop I and complete Experiment 1. Describe your observations in your science notebook (use the reproducible experiment pages or any other notebook).

Day 3 – Complete the Newton biography.

Day 4 – Write a book report, lead a discussion, or do an oral presentation of Isaac Newton.

noeo science

PHYSICS 3

Week 5 – Forces and Motion				
	Day 1	Day 2	Day 3	Day 4
Exploring the World of Physics	Pp. 14 – 18 (through the second paragraph)		Pp. 18-22	Pg. 23
Physics: Why Matter Matters!	Pp. 16-24			
Physics Workshop Experiment Manual		Pp. 12-14		

Supply List: Physics Workshop experiment kit, stopwatch (or watch with second hand), tape measure or ruler

Assignments:

Read the assigned pages and/or complete the experiment(s). In your own words, describe what you have learned. Use the reproducible sheets to create a science notebook for writing/sketching important ideas. At a *minimum*, be sure to report on the “**Keys to Understanding**” items below. Use the reproducible experiment pages to document your laboratory exercises.

Keys to Understanding:

Day 1 – Explain Newton’s first and second laws of motion. **Define: inertia, friction, force, acceleration**

Day 2 – Build the All-Terrain Vehicle in Workshop IV and complete Experiment 3. Describe your observations in your science notebook.

Day 3 – Explain Newton’s third law of motion. **Define: impulse, velocity, momentum**

Day 4 – Answer the questions, reviewing those areas in which you might not be sure. Check your answers with the key on p. 155.

noeo science

PHYSICS 3

Week 6 – Forces and Motion				
	Day 1	Day 2	Day 3	Day 4
Exploring the World of Physics	Pp. 24-27 (all but the last paragraph)	Pp. 27b -32 (skip the text in the gray boxes for now)	Pp. 29 & 31	
Physics: Why Matter Matters!		Pp. 8-13 & 26		
Physics Workshop Experiment Manual			Pp. 9-10 Begin at the “Where is it Pulling Us?” paragraph	Pp. 14-16 Stop at “How Do You Measure Force?”

Supply List: Physics Workshop experiment kit

Assignments:

Read the assigned pages and/or complete the experiment(s). In your own words, describe what you have learned. Use the reproducible sheets to create a science notebook for writing/sketching important ideas. At a *minimum*, be sure to report on the “**Keys to Understanding**” items below. Use the reproducible experiment pages to document your laboratory exercises.

Keys to Understanding:

Day 1 – Explain Kepler’s Three Laws of Planetary Motion. Why are these significant?

Day 2 – What is the difference between mass and weight?

Day 3 – Build the Center of Gravity Locator in Workshop II and complete Experiment 2. Describe your observations in your science notebook.

Define: center of gravity

Day 4 – Build the Fall Speed Indicator in Workshop V and complete Experiments 4-6. Describe your observations in your science notebook.