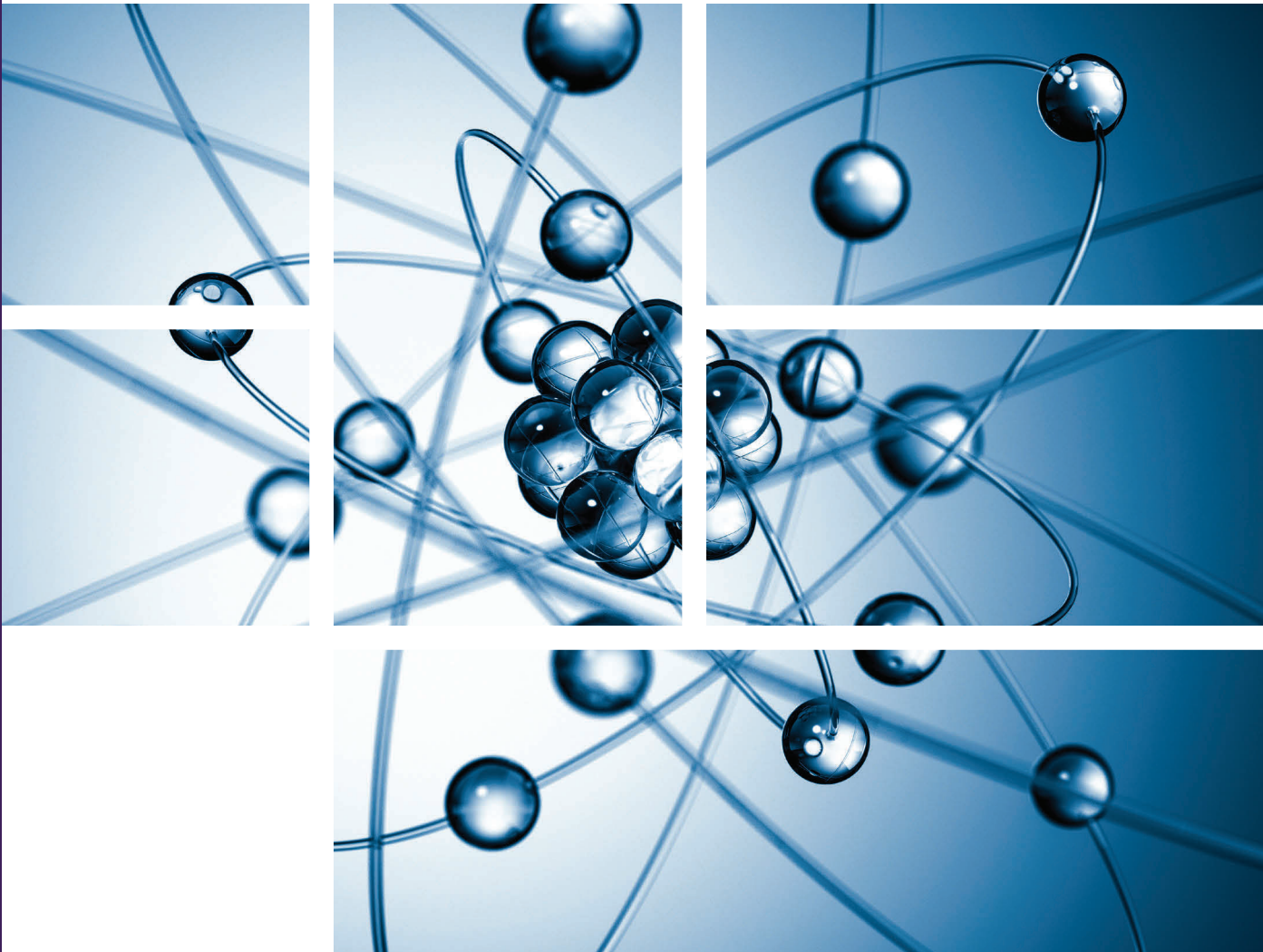


HIGH SCHOOL PHYSICS

Level 450

SCHEDULE PLUS





Thank you for downloading this sample of Sonlight's Science 450 Schedule Plus (referred to as the Science Schedule Plus at this level). In order to give you a full perspective on our Instructor's Guides, this sample will include parts from every section that is included in the full IG.

Here's a quick overview of what you'll find in this sample.

- A Quick Start Guide **START HERE**
- A 3-week Schedule & Detailed Teaching Notes
- Sample Experiment Forms

SONLIGHT'S "SECRET" COMES DOWN TO THIS:

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If you need any help using or customizing our IGs, please reach out to our experienced homeschool advisors at sonlight.com/advisors.

We hope you enjoy using this sample. For even more information about Sonlight's IGs, please visit: sonlight.com/ig. It would be our pleasure to serve you as you begin your homeschool journey. If you like what you see in this sample, visit sonlight.com/science to order your Science package.

Blessings!

Sarita Holzmann,
Co-founder and president
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Science

Physics Schedule Plus

By the Sonlight Team

Sonlight Curriculum® Science 450 “Physics Schedule Plus,” Thirteenth Edition

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“Do to others what you would have them do to you” (Matthew 7:12).

“The worker is worth his keep” (Matthew 10:10).

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NOTE TO PURCHASER

Sonlight Curriculum, Ltd. is committed to providing the best homeschool resources on the market. This entails regular upgrades to our curriculum and to our Instructor’s Guides. This guide is the 2020 Edition of the Sonlight Curriculum® Science 450 “Physics Schedule Plus.” If you purchased it from a source other than Sonlight Curriculum, Ltd., you should know that it may not be the latest edition available.

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INSTRUCTOR'S GUIDES SCIENCE

Special features of Sonlight's Science Schedule Plus Guides:

1 A Weekly Schedule & Detailed Teaching Notes

All your books and experiments are fully scheduled for the entire year. The weekly schedules let you see your entire week at a glance. The first column lists the titles of each book or assignment. Follow either the Textbook OR the CD-ROM version (but not both). The remaining columns include the day-by-day assigned pages or tasks.

2 Organizational Tools to Help You Plan Ahead

See at a glance the supplies you need for experiments this week and the following week. Know what supplies you'll find in the Sonlight Science Kits, and which household items you'll want to have ready.

3 Extra Helps

Immediately following each week's schedule page, you will find vocabulary your children will need to memorize. Your primary task: read the assigned pages in the Textbook or on the computer (CD-ROM) listed in the schedule, then memorize the vocabulary terms. You'll find comprehension questions throughout the textbook or CD-ROM as well as tests for each module. Tests can be printed out from the CD-ROM or sold as a separate packet with the Textbook version.

4 Experiment Forms

The back section of the Science Schedule Plus includes experiment write-ups to use in conjunction with the labs you complete each week. Use the examples to help your student record pertinent information from their labs. Feel free to copy as many as your student needs. Each experiment is scheduled out for you.

Week 1—Module 1					
Date:	Day 1	Day 2	Day 3	Day 4	Day 5
Discovering Design with Chemistry	pp. 1–5	pp. 6–9 (up to Converting Between Units)	pp. 9–13 (through Comprehension Check)	pp. 13–18 (up to Converting Between Volume Units)	pp. 18 (top)–22 (through Comprehension Check)
Comprehension Check	#1–2	#3–4	#5–6	#7–8	#9–12
Experiments		1.1		1.2	
Vocabulary ¹	☐	☐		☐	☐
Supplies ²	We Provide: 355-05—safety glasses, funnel, graduated cylinder, medicine dropper You Provide: ruler(s) with inches and centimeters, soft covered book, small cylindrical container, like a pill bottle or spice jar (must be able to hold water), water, sink				
Shopping/Planning List	For next week: We Provide: 355-05—safety glasses, graduated cylinder, mass scale ³ , medicine dropper, 250-mL beaker You Provide: water, cooking oil, table salt in a salt shaker				
Other Notes					

Be familiar with all words **bolded** in the text.

Week 1—Module 1

Significant figure: A digit in a measurement that contributes to the measurement's precision. [p. 4]

Rules for determining significant figures: [p. 4]

- All non-zero figures (1, 2, 3, 4, 5, 6, 7, 8, 9) are significant.
- A zero is significant if it is between two significant figures.
- A zero is significant if it's at the end of the number AND to the right of the decimal point.

When adding and subtracting measurements, you must report your answer to the same precision as the least precise number in the problem. [p. 6]

When multiplying and dividing measurements, you must report your answer with the same number of significant figures as the measurement which has the fewest significant figures. [p. 7]

There is always some error in the last significant figure of the measurement. [p. 9]

1 cm³ = 1 mL. [p. 18]

Weight: A measure of how strongly gravity pulls on an object. [p. 20]

Mass: A measure of how much matter exists in an object. [p. 20] ■

Chemistry Experiment Write-Up—Example 1

Date: _____

Experiment: # _____

Title/Purpose: _____

Supplies: _____

Procedure: _____

Hypothesis: _____



At a Glance

Our goal in teaching science to high school students is to make them aware of the amazing realities around them and how complex and detailed this world is in which we live. You may want to join your students in this adventure, offer support as needed, or allow them to work through this book on their own since it is written to the student. Some of the science concepts they have been exposed to in the past will now come into sharper focus with more detailed study in certain disciplines.

- “High School Physics” includes a basic study in the field of physics.
- It is an upper high school-level course. It is recommended that it follow a chemistry course.
- Remember, it is designed for students who have completed Algebra II and have had some exposure to vectors (or will have some exposure concurrently in an advanced math class).
- We stress mastery of concepts and vocabulary at this level.

Your student:

- Will be introduced to one-dimension and two-dimension motion, velocity, acceleration, sound waves, light, Newton’s Laws, gravity, momentum, periodic motion, waves, optics, work and energy, electrical circuits, magnetism, and other general areas of physics.
- Will have concepts reinforced through the labs.
- Can use this class as a stepping-stone into Advanced Physics.

We include:

- Sample Experiment Forms with guidelines to be used as you work through the scheduled labs.
- Weekly vocabulary lists.
- A weekly planning list to determine the lab materials needed for the coming week, as well as a look ahead to the needed items for the next week.

An Overview of this Year’s Studies

Each of the 16 modules is broken down into daily readings. Most modules are scheduled to be completed in two weeks, with four modules taking three weeks. It is important to read the introductory pages in the text book and the Solutions Manual.

For those who have not taken Dr. Wile’s chemistry course, there is a 4-page section before Module 1 that reviews units in equations and their conversions, measurements, significant figures, scientific notation, etc. These are used extensively throughout the year and are much needed to be able to work through this course. If this is all new, or you need a greater review, you will find a

website listed in the introduction of the student book that will give you access to Module 1 of the chemistry book where you will find explanations of these skills.

In each week’s schedule, we have noted the science supplies needed from the Physics Supplies Kit (**450-15**). The rest will be supplies you are expected to provide.

We alert you to needed supplies one week in advance so you can plan ahead. This way you have time to obtain the item(s) before you do the next week’s experiments. We hope this feature will enable you to feel well-prepared and organized for your science adventure!

Your student will want to use a scientific calculator for this class. It must have basic functions, as well as square root, sine, cos, \tan^{-1} , \sin^{-1} , and EE (or a similar way to work with exponents when dealing with scientific notation). Tips for using the calculator follow, along with notes about typical pitfalls for many students.

CD ROM

For those using the full course of *Exploring Creation with Physics* on CD ROM, you will find an additional line in the schedule. Since the full course CD does not have page numbers, but is identified by sub-headings, usually it is suggested you read “through” a section. Many of these sections have questions at the end entitled “On Your Own.” If they follow a section, they are meant to work through in order to “complete” that section. Also, since the “On Your Own” questions are not numbered, you will need to keep track that you have done the correct number of them for the day. For instance, if you see that you were to do 6.3–6.7, then you would need to complete five questions during your reading time that day. For your convenience, we tried to let you know how many to expect for the day’s reading.

Parents, please note all review questions, practice questions, and extra practice questions along with their solutions are found in a separate CD titled “Solutions and Tests.” At the end of each module, you will be asked to print off the appropriate pages for the module. Your student is then to practice the material and have it corrected before you print out the test. The solutions for the tests are also found on that same CD.

Multimedia Companion CD

There is also a schedule for those who purchased the supplemental *Multimedia Companion CD*. The CD contains extra helps including explaining some of the examples, pronunciations and demonstrations of a concept. If you own the full course on CD ROM, you will find the material from the *Multimedia Companion CD* included on your full course CD ROM.

Testing

There is a test for each of the 16 modules throughout the year. Because of this, we have not scheduled any of the quarterly tests as this would have taken away some of the extra time given for some of the harder modules. You may add a quarterly test after every four modules, if you prefer.

One way of scheduling would be to complete the three week modules in two weeks (for example: Week 9 could be a study week for a quarterly test if you complete Module 1 in Weeks 1 and 2).

While we do feel that the quarterly tests are a useful evaluation tool, we don't feel they are "required." Certainly the end-of-module study guide questions and tests are sufficient to determine your student's understanding of the material. If you are concerned about long-term retention, you may find the quarterly tests to be helpful.

Tips for Using your Calculator

It is very important that you become familiar with how to use the calculator due to the large amount of math in this course. Many times the final answer is wrong not because of the set-up, but because it was entered into the calculator incorrectly.

There are numerous calculators on the market. Not all scientific calculators are marked the same way or have all the same options. Therefore, the following may need to be adapted for yours in particular.

Here we offer help with the most common errors. We have not included units in these demonstration equations so you can generalize for any similar math set-up. However, it is very important to keep track of your units when doing the actual problem.

Basics

Whether you have a standard scientific calculator or a graphing calculator, you will need to find:

- brackets ()
- EE or exp (often this may be in conjunction with the yellow "second" button)
- x^2 = this button will square the number you enter.
i.e. $15^2 = 15 \times 15 = 225$
- \wedge = this is used when you have to multiply a number by itself more than twice: i.e., $15^3 = 15 \wedge 3 = 3375$ (or 3.4×10^3) using significant figures
- Square root $\sqrt{\quad}$
- ANS (answer key; again may be in conjunction with the yellow "second" key)

Before You Begin

First check to make sure your calculator is in DEG (degree) mode. You can usually see the DEG on the screen once it is turned on. If it says anything different, check your manufacturer's directions for changing it back to Degree mode.

Let's Practice

A number is made negative by using the (-) key which is often found by the decimal point. Do not use the subtraction sign to designate a negative number.

You will enter multiple numbers that are in scientific notation (5.6×10^6). This is quickly entered by

$$5.6 \text{ EE } 6$$

Remember: to get the EE or exp you often must push the yellow "2nd" button first.

Try it as a number with a negative exponent:
 5.6×10^{-6}

$$5.6 \text{ EE } (-) 6$$

Remember the (-) is not the subtraction sign (nor are there actual brackets placed around the negative sign).

Some students use the \wedge key for these same numbers, but that is a longer process. Also, it doesn't always give you the correct answer in complicated equations because the brackets are typically not used as much as necessary when setting up a number in scientific notation using $x10^\wedge$. It is still more efficient to use the EE button when entering numbers in scientific notation.

$$5.6 \times 10^\wedge (-) 6$$

Equations

$$\frac{0.15 \cdot 32}{27} = .15 \times 32 \div 27 =$$

And your answer should be .17777 rounded to .18

However, when you have multiple numbers in the denominator it is most efficient to use brackets.

$$\frac{0.15 \cdot 32}{27 \cdot .30} = (.15 \times 32) \div (27 \times .30) = .59$$

Many students want to put this type of problem in as follows: $.15 \times 32 \div 27 \times .30 =$ but your answer will be wrong (.053) because you have just multiplied .30 to the answer so far rather than dividing it out since it is in the denominator.

Your other option is to remember what you are doing (dividing out each number in the denominator).

$$.15 \times 32 \div 27 \div .30 = .59$$

Square Root

If you need to get the square root of the answer above (once you obtain the .59) then enter $\sqrt{\quad}$ (you may need to use the second button) and ANS (again, you may need to use the second button). This gives you the square root of the answer you had just calculated.

Remember your brackets help to separate sections. It is also important to close the brackets.

One last try ...

$$\frac{1.14^2}{.121 \cdot .234^3} = .14 \times 2 \div (.121 \times .234^3) = 838$$

Corrections and Suggestions

Since we at Sonlight Curriculum are constantly working to improve our product development, we would love it if we could get you to help us with this process.

Whenever you find an error anywhere in one of our Instructor's Guides, please check our updates page for the latest information at www.sonlight.com/curriculum-updates. Report new information by sending a short e-mail to: IGcorrections@sonlight.com. It would be helpful if the subject line of your email indicated where the problem is. For instance, "Physics/Section One/Week 1/Schedule."

If while going through our curriculum you think of any way we could improve our product, please e-mail your suggestions to: IGsuggestions@sonlight.com. If you know of a different book we should use, if you think we should read a book we assign at a different point in the year, or if you have any other ideas, please let us know.

How to Use the Experiment Forms

Question/Title

This usually comes directly from the title of the experiment/lab title at the top of the experiment in the book. It may help to put it into a question so you can fit the pieces together when you get to the inference at the end. If the title isn't revealing enough, make sure you read the experiment carefully all the way through. Then look at the subheading and read the paragraph preceding the experiment. All those things will help you write a more informative title.

Materials

List those materials that help you identify the experiment.

Method

Briefly write down what is to be done during this experiment. It does not need to restate each step as listed in the book, as you should know what the experiment involves. If there are several parts to the procedure, write each down.

For example: If you are to hold a comb just above small pieces of aluminum foil first without pulling the comb through your hair and then again after pulling the comb through your hair, write both parts down. Do not skip a part of the procedure even if you know what will happen.

Hypothesis

A hypothesis is an educated guess. Often you know what should happen after reading the experiment. Still, write down what you expect to happen. You do not need to write "why" because that will come later.

Do not add inference to your hypothesis. For instance: "The steady stream of water will bend toward the charged comb because the partial positive charges are attracted to the negative charge in the comb, whereas the steady stream of oil will not bend because it is a purely covalent compound ..."

Instead write down just what you expect to see. "The steady stream of water will bend toward the charged comb, however there will be no change in the steady stream of oil."

Observation

Be detailed. Write down what you see in more than general terms.

For instance, to say something bubbled is not enough. That statement can cover small bubbles forming in a substance to bubbling so rapidly and violently it comes to the top of the beaker and spills over! So, you shouldn't use the same description for both of these scenarios. It is important to be detailed in your descriptions.

"The toilet bowl cleaner quickly foamed approximately half way up the beaker where it stayed as it continued to react with the eggshell."—Or—"Once the yeast was added and the beaker swirled, then the reaction included large bubbles which rose quickly until they hit the watch glass and still pushed out of the spout to the outside of the beaker. Much of the yeast could still be seen sitting on the top of the bubbles."

Inference

This is the heart of the experiment. So far you wrote down what you were looking for (question), what you used (materials), what you did (procedure), what you expected to happen (hypothesis), and what actually did happen (observation/data). Now it is time to write up what you learned. This is not a place to say "... it is just as I expected" or "... my hypothesis was correct." Write what you actually learned by tying your question and hypothesis together and then looking at your data.

Often you will find the information just following the experiment. Dr. Wile is careful to help you see what you should have learned. But sometimes you have to remind yourself what you were looking for. And you need to be complete.

To say "the ball didn't hit my nose when it swung back toward me" is not enough. You would need to include the point of the experiment and what is learned. For instance: "The mass could not climb higher than the original place of release since it could not have more kinetic energy than the initial total energy (potential energy in this case) that it started with (since it was only released and not pushed). Also, the mass could not reach the same height

as the swing before since, while it was moving, some of the kinetic energy was being transferred to heat as a result of the work of friction. So it had less kinetic energy to change to potential energy each time it swung up toward my nose.” (8.1)

The point of an experiment is to demonstrate and reinforce a concept you have learned in a particular section of your physics book. Take advantage of spending the time to see what you are supposed to be learning from each experiment. If you remember your experiments, you can refer back to them when reviewing the concepts. Remember, the experiments are not put there for something to do, but rather to apply what you have learned in the written word by seeing it in action.

Summary

We hope that you enjoy your adventure this year and that it helps you learn more about the world we live in. If we can be of any assistance, please do not hesitate to e-mail us at main@sonlight.com, call us at (303) 730-6292, or better yet, join our Sonlight Connections Community (sonlight.com/connections), where you can chat with others who are going through this same program. You can ask questions, learn new ideas, share with others what you have learned, problem-solve, or just talk. Happy exploring! ■

Physics Schedule Plus—Science Supplies

450-15 (Physics Supplies Kit) Item	Week(s) Used
Masking tape	2, 18
Protractor	5, 6, 26
Clay	5
Rubber band	8, 11
Aluminum foil	11, 28, 30, 32
Washers	16
Marble	18
Large paper clips	22, 28, 30, 35
Black construction paper	26
Mirror	26
Balloons	28, 30
AA 1.5-volt battery	32, 35
Insulated wire	32, 33, 35
Toothpick	35
Compass	35
SS301 Safety glasses	1, 2, 3, 4, 5, 8, 11, 13, 14, 16, 18, 20, 22, 23, 24, 26, 28, 30, 32, 33, 35

Section Two

Schedule and Notes

Week 1—Module 1

Date:	Day 1 ¹	Day 2 ²	Day 3 ³	Day 4 ⁴	Day 5 ⁵
Exploring Creation with Physics	pp. 1–4	pp. 5–12 (top)	pp. 12–16 (through first full para.)	pp. 16 (para. above graph)–21 (top)	pp. 21–23 (top)
Exploring Creation with Physics—CD ROM ¹	“Introductory Remarks”	“Introduction” through second “On Your Own”	“Speed and Velocity 2” through sixth para. in “Average and Instantaneous Velocity 2”, and one “On Your Own”	“Average and Instantaneous Velocity 2” (para. above Fig. 1.3) through “Average and Instantaneous Velocity 3” and one “On Your Own”	“Velocity Is Relative” through one “On Your Own”
Multimedia Companion CD		Examples 1.1 and 1.2	Example 1.3	Example 1.4	
On Your Own		1.1–1.2	1.3	1.4–1.6	1.7
Experiments			1.1		
Vocabulary ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Supplies ³	You Provide: stopwatch, pile of books, pencil, ball, wooden board about 1 meter long, safety glasses.				
Shopping/Planning List	For next week: We Provide: 450-15—masking tape. You Provide: stopwatch, pile of books, pencil, ball, uncarpeted floor, wooden board about 1 meter long, safety glasses.				
Other Notes					

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1. The “Exploring Creation with Physics—CD ROM” schedule is for the full course CD ROM version of the text. It is identical to the page designations given for the text, *Exploring Creation with Physics*. You will use either the textbook *Exploring Creation with Physics* or the CD ROM version. You do not need both versions to complete this course.

2. Define vocabulary terms and names found in each day’s reading, then place a check in the box.

3. When supplies are listed as “**We Provide:**” they are materials found in your Physics Supplies Kit (450–15). When supplies are listed as “**You Provide:**” they are materials you can generally find around your home.

Vocabulary | Terms and Important Facts

Review from Chemistry

Introductory Remarks

Significant figures: A digit within a number is considered to be a significant figure if: [p. 3]

1. It is non-zero OR
2. It is a zero that is between two significant figures OR
3. It is a zero at the end of the number and to the right of the decimal point.

Adding and Subtracting with Significant Figures: When adding and subtracting measurements, round your answer so that it has the same precision as the least precise measurement in the equation. [p. 4]

Multiplying and Dividing with Significant Figures: When multiplying and dividing measurements, round the answer so that it has the same number of significant figures as the measurement with the fewest significant figures. [p. 4]

Distance and Displacement

Displacement: The change in an object's position. [p. 6]

Vector quantity: A physical measurement that contains directional information. [p. 6]

Scalar quantity: A physical measurement that does not contain directional information. [p. 6]

Speed and Velocity

Velocity: The time rate of change of an object's position. [p. 8]

Velocity equation: [p. 9] $v = \frac{\Delta x}{\Delta t}$

Speed: The time rate of change of the distance traveled by an object. [p. 9]

Speed equation: [p. 9] $Speed = \frac{\Delta d}{\Delta t}$

Average and Instantaneous Velocity

Instantaneous velocity: The velocity of an object at one moment in time. [p. 13]

Average velocity: The velocity of an object over an extended period of time. [p. 13]

Average and Instantaneous Velocity 2

The slope of a position-versus-time curve is the velocity. [p. 17] ■

Week 2—Module 1

Date:	Day 1 ⁶	Day 2 ⁷	Day 3 ⁸	Day 4 ⁹	Day 5 ¹⁰
Exploring Creation with Physics	pp. 23–27 (mid-page)	pp. 27–29; p. 34 Review #1–10	pp. 35–36 Practice #1–10	pp. 563–564 Extra Practice Problems for Module 1; Review for Test	Module 1 Test
Exploring Creation with Physics—CD ROM	“Acceleration” through three “On Your Own”	“Average and Instantaneous Acceleration” through “Average and Instantaneous Acceleration 2” & Review #1–10 and one “On Your Own”	Practice #1–10	Extra Practice Problems for Module 1; Review for Test	Module 1 Test
Multimedia Companion CD	Example 1.6				
On Your Own	1.8–1.10	1.11–1.12			
Experiments	1.2				
Vocabulary	□	□			
Supplies	We Provide: 450-15 —masking tape. You Provide: stopwatch, pile of books, pencil, ball, uncarpeted floor, wooden board about 1 meter long, safety glasses.				
Shopping/Planning List	For next week: You Provide: large heavy book, a small piece of paper, ruler (preferably metric), helper, safety glasses.				

Other Notes

Vocabulary | Terms and Important Facts

Acceleration

Acceleration: The time rate of change of an object’s velocity. [p. 23]

Acceleration equation: [p. 23] $a = \frac{\Delta v}{\Delta t}$

Average and Instantaneous Acceleration

The slope of a velocity-versus-time curve is the acceleration. [p. 27]

Average and Instantaneous Acceleration

If velocity is zero, acceleration does not have to be zero. [p. 29]

If acceleration is zero, velocity does not have to be zero. [p. 29] ■

Week 3—Module 2

Date:	Day 1 ¹¹	Day 2 ¹²	Day 3 ¹³	Day 4 ¹⁴	Day 5 ¹⁵
Exploring Creation with Physics	pp. 37–43 (bottom)	pp. 43–47 (mid-page)	pp. 47–50 (bottom)	pp. 50–54 (through first full para.)	pp. 54 (para. before experiment)–57 (top)
Exploring Creation with Physics—CD ROM	“Introduction” through second “On Your Own”	“Relating Displacement, Velocity, Acceleration, and Time” through one “On Your Own”	“Using Our Equations for One-Dimensional Motion” through three “On Your Own”	“Free Fall” up to last paragraph in “Free Fall 2”	“Free Fall 2” (last para.) through two “On Your Own”
Multimedia Companion CD	Examples 2.1 and 2.2	Example 2.3	Example 2.4	Acceleration due to gravity	Example 2.5
On Your Own	2.1–2.2	2.3	2.4–2.6		2.7–2.8
Experiments				2.1	2.2
Vocabulary	☐	☐	☐	☐	
Supplies	You Provide: large heavy book, a small piece of paper, ruler (preferably metric), helper, safety glasses.				
Shopping/Planning List	For next week: You Provide: a large, heavy book; four small (about 10 cm x 10 cm) pieces of paper.				
Other Notes					

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Vocabulary | Terms and Important Facts

Relating Velocity, Acceleration, and Time [p. 38]

$$v = v_o + at$$

Relating Velocity, Acceleration, and Displacement [p. 41]

$$v^2 = v_o^2 + 2a \cdot \Delta x$$

Relating Displacement, Velocity, Acceleration and Time [p. 46]

$$\Delta x = v_o t + \frac{1}{2} at^2$$

Using Our Equations for One-Dimensional Motion

The above equations are valid only when the acceleration is constant. [p. 48]

Free Fall

Objects falling near the surface of the earth experience a constant acceleration of 9.8 m/sec² (32 feet/sec²) straight down. [p. 51]

The acceleration due to gravity is independent of the nature of the object experiencing free fall, as long as the object has mass. [p. 52]

Free Fall 2

Air resistance: The drag that air produces on objects traveling through it. [p. 53] ■

Forms for Experiment Write-Ups

Physics Experiment Write-Up—Example 1

Date: _____

Experiment # _____

Question/Title: _____

Materials: _____

Method: _____

Hypothesis: _____

Physics Experiment Write-Up—Example 2

Date:

Experiment: #

Title/Question:

Materials:

Method:

Hypothesis:

Observation:

Inference:



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