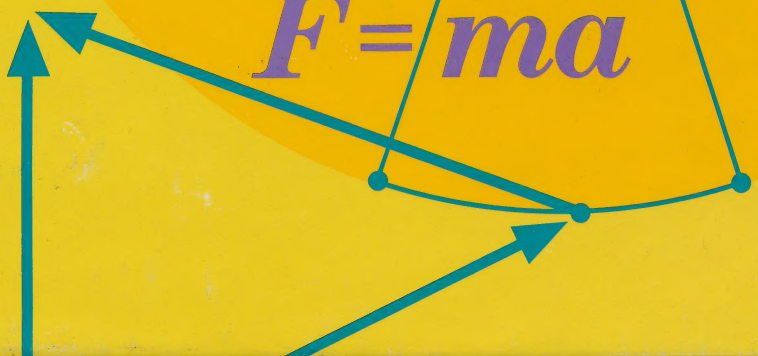
Sensei™ Software For Learning

Published by Brøderbund Software

Physics

For Apple Macintosh™

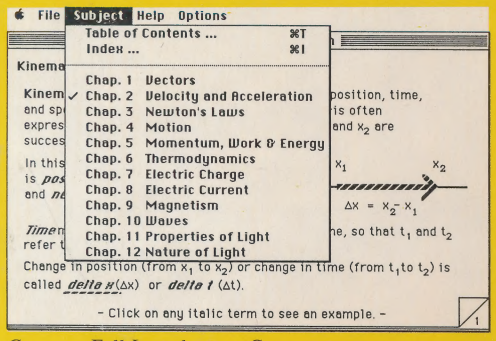
$F = ma$



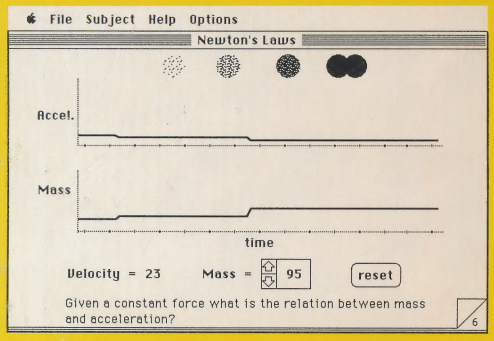
I hear and I forget
I see and I remember
I do and I understand

Ancient Proverb

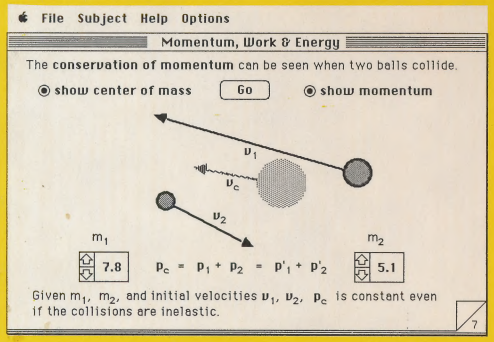
Physics is a powerful new program that acts as your private tutor. It reviews, complements and amplifies an introductory course in classical mechanics using the interactive abilities of the Macintosh.



Covers a Full Introductory Course



Extensive Animation



Interactive, Immediate Feedback

A full year's course in a single program

Physics follows a classic curriculum and has been designed with and tested by educators. It is compatible with major textbooks and provides solid coverage of these fundamentals:

• Vectors • Velocity and Acceleration • Newton's Laws • Projectile, Circular, Angular and Simple Harmonic Motion • Momentum, Work and Energy • Thermodynamics • Electric Charge • Electric Current • Magnetism • Reflection and Refraction • Particle Theory of Light • Wave Theory of Light

Physics is software for learning

Master an entire year's material at your own pace. Using interactive graphics, you can explore and investigate the basic concepts of physics. Abstract methods and formulas come to life on the screen as you learn how to manipulate vectors, interpret graphs, and answer problems. Experiment with velocity and force to see changes in orbital motion. Work with dynamic, kinetic and potential energy simulations to understand their relationships.

Extensive review and practice of problems

Physics has over 300 problems. Learn, review, and test yourself, solving the kinds of problems found in homework and exams. Whatever approach you choose to take, help is always immediately available–in the form of hints, further explanations or answers to problems. Physics has an automated Index and Table of Contents for quick access to any subject.

Physics is one in a series of math, science, and liberal arts programs from Sensei Software. (Sensei, pronounced *sen-say*, is the Japanese word for "master" or "teacher.") Sensei programs present material in intriguing, interactive ways to help students achieve mastery of key concepts and better their performance in homework and on tests.

For more information about Sensei and our products, write to us at 17 Paul Drive, San Rafael, CA 94903-2101. Published by Brøderbund Software, Inc.

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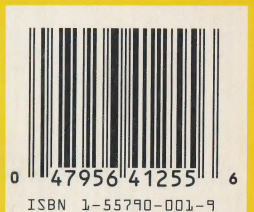


ISBN 1-55790-001-9

Physics

Macintosh
512E, Plus, SE, II
800K

Sensei Software
Published by
Brøderbund Software
17 Paul Drive
San Rafael, CA 94903

039

Physics

Manual addendum for the 800K version

The following information is for the new 800K version of the program. Please disregard information in the manual regarding 400K disks or creating 800K disks.

System Requirements: PHYSICS requires a Macintosh 512K Enhanced, Macintosh Plus, Macintosh SE or Macintosh II.

Making a Copy: Start by making a copy of your program disk. You should always use a copy of PHYSICS rather than the original disks. Consult your Macintosh manual if you need help.

If you have a hard disk, create a new folder on the hard disk. Copy the contents of PHYSICS into the new folder. To do this, select all the files and drag them over to the Hard Disk.

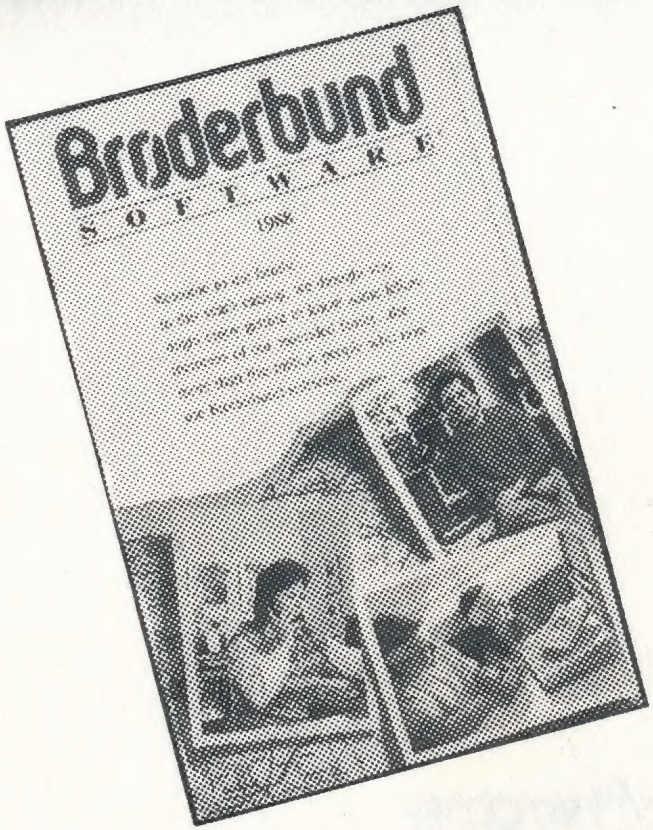
The PHYSICS disk is a special master disk. Each time you start PHYSICS with your copy, the Macintosh will ask you to insert your original disk. This enables the Macintosh to read the identification on the original disk.

This program is copy protected. If you would like a backup copy of the program, mail your proof of purchase, along with a check or money order for $10.00 (in U.S. funds), or complete credit card information, to the address listed below.

Special note for owners of 512K Macintosh computers

If you have a 512K Macintosh with a 400K internal drive and a 400K external disk drive, request the 400K version and Broderbund will send you two 400K disks. Send your disk and your proof of purchase to:

Broderbund®
Software Direct®
P.O. Box 12947
San Rafael, CA 94913-2947



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Fill out the questionnaire on the reverse side and enter our monthly drawing. Every month a name is selected from the returned questionnaires. The winner chooses FREE software from a featured selection. The more questionnaires you return, the better your chances of winning...It's that easy!

We will also add you to our mailing list enabling you to receive new product announcements, update information and more.

Please take a few minutes to respond to the following questions and send the card to us. This will assist us in providing you with the first-rate software you deserve.

After completing the questionnaire, fold card in half, seal and mail.

SEAL HERE

NAME _____ TITLE _____

SCHOOL/ORGANIZATION _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE NUMBER (daytime) _____ (evening) _____

What is the age of the person who will use this program most often?

☐ Under 13 years ☐ 19-24 ☐ 35-44
☐ 13-18 ☐ 25-34 ☐ 45+

Is the person:

☐ Male
☐ Female

Where did you purchase this program?

☐ Computer Hardware & Software Only Store
☐ Computer Software Only Store
☐ Department Store
☐ Discount Store
☐ Book Store
☐ Mail or Phone Order
☐ Gift
☐ Educational dealer
☐ Educational catalog
☐ Other
☐ Don't Know

Was this program purchased for use in your

☐ home ☐ business ☐ school

If you checked school: Did you purchase this for your

☐ classroom ☐ computer lab ☐ media center ☐ district

How do you find out about software? (check all that apply)

☐ reviews ☐ catalogs ☐ dealers ☐ shows ☐ ads ☐ friends ☐ other

Do you work on a computer at both your home and place of business?

☐ Yes ☐ No

What type of computer do you use?

Home

☐ Apple IIe/IIc
☐ Apple IIGS
☐ Atari
☐ Commodore
☐ IBM/compatible
☐ Macintosh 512/Plus
☐ Macintosh II
☐ Macintosh SE
☐ Other

Business

☐ Apple IIe/IIc
☐ Apple IIGS
☐ Atari
☐ Commodore
☐ IBM/compatible
☐ Macintosh 512/Plus
☐ Macintosh II
☐ Macintosh SE
☐ Other

Which of the following peripherals/accessories do you own/use? (check all that apply)

Printer:

☐ Dot Matrix
☐ Letter Quality
☐ Color
☐ Laser

Monitor:

☐ Color
☐ Monochrome

☐ Joystick
☐ Mouse
☐ Stylus/Graphics Tablet

☐ Hard Disk (20 MB and less)
☐ Hard Disk (more than 20 MB)
☐ 3½" Disk
☐ Modem (1200 baud and under)
☐ Modem (2400 and above)

How much memory does your computer have?

☐ 48K ☐ 64K ☐ 128K ☐ 256K ☐ 512K ☐ 640K ☐ 1024K

Of which of the following magazines have you read at least three of the last six issues? Check box A. Which of these do you subscribe to? Check box B.

A	B		A	B		A	B	
☐	☐	A+	☐	☐	Infoworld	☐	☐	P.C. World
☐	☐	Classroom Computer Learning	☐	☐	Instructor	☐	☐	Personal Computing
☐	☐	Compute!	☐	☐	MacUser	☐	☐	Power Play/Microcomputing
☐	☐	Compute!'s Gazette	☐	☐	Macworld	☐	☐	RUN
☐	☐	Compute! ST	☐	☐	Nibble	☐	☐	STart
☐	☐	Electronic Learning	☐	☐	P.C. Magazine	☐	☐	Teaching and Computers
☐	☐	Family Computing	☐	☐	PC Week	☐	☐	The Computing Teacher
☐	☐	Incider				☐	☐	T.H.E. Journal

Are you planning to purchase a computer in the next 12 months?

☐ Yes ☐ No

If yes, what type?

☐ Apple IIe/IIc
☐ Apple IIGS
☐ Atari
☐ Commodore
☐ IBM/compatible
☐ Macintosh 512/Plus
☐ Macintosh II
☐ Macintosh SE
☐ Other

41255

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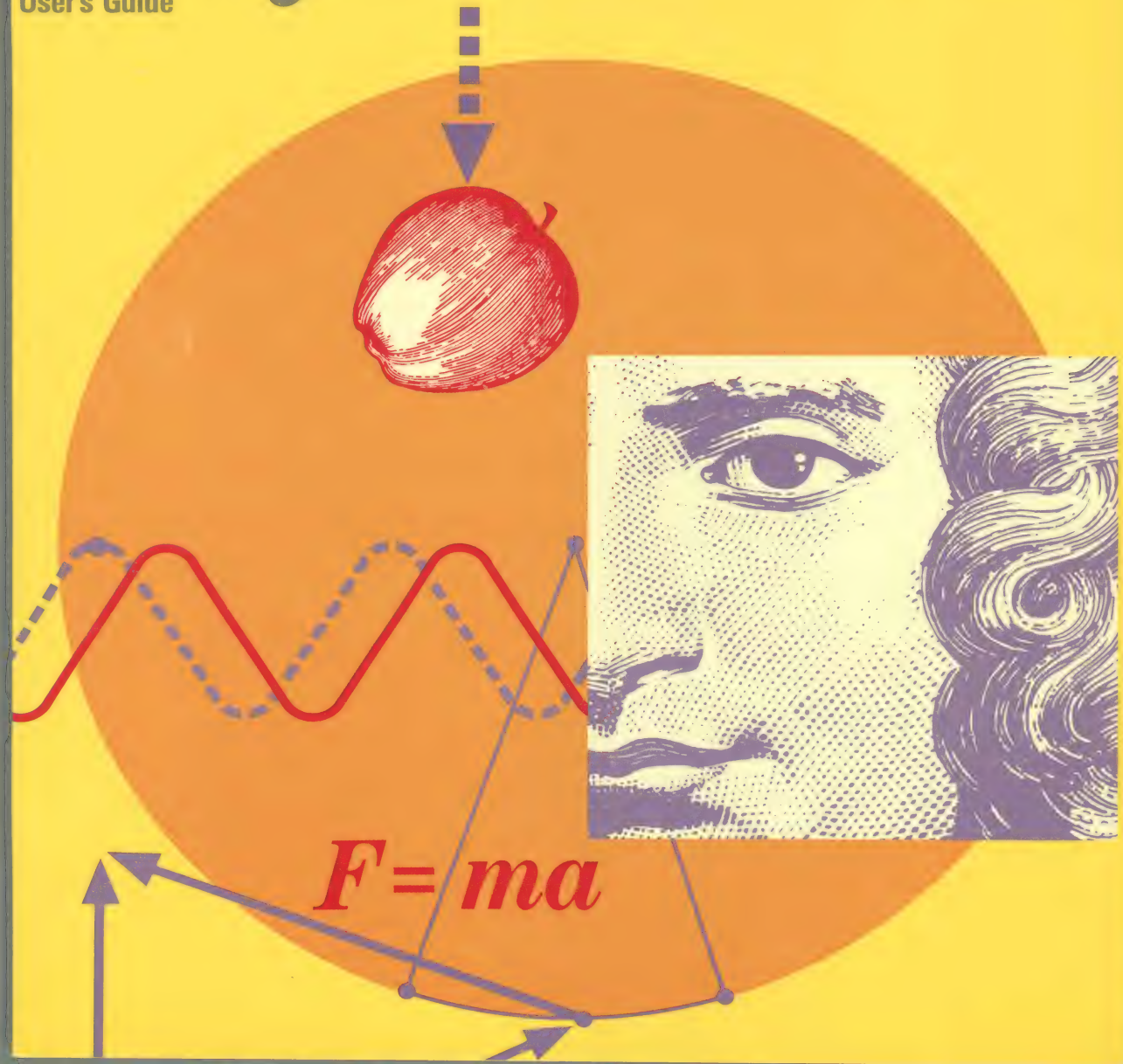
Sensei™ Software For Learning

For Apple Macintosh®

Physics

User's Guide



Physics

Sensei team (design, animation, architecture, tools): Michael Coffey, Eric Deeds, Steve Patrick, Tomi Pierce, Loring Vogel

Loring Vogel: Program Design, Animations, Technical Direction
Eric Deeds: Program Design, Project Integration
Michael Coffey: Shell, Programming Tools
Robert Latham: Primary Academic Consultant
Ray Marchesi: Academic Reviewer and Consultant
Ty Shipman: Additional Programming
Alison and Paul Woods: Package Design
Tomi Pierce and Steve Patrick: Producers

We would like to thank Doug Carlston, Robert M. Fell, Cathy Carlston, Moira Cullen, Michael Shorrock, Larry Berkin, Joanna Witzel, Robert Strobel, Keven Knuth, Dave Davis, Randy Buck and Alan Mirviss.

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Contents

Introduction

PHYSICS

PHYSICS is a program that acts as your own private tutor: it reviews, amplifies, and complements an introductory physics course using the interactive capabilities of the Macintosh.

PHYSICS is a blend of tutorial material, over 300 problems, and special interactive animation that allows you to experiment with the basic concepts of physics. You can learn, review, and experiment with PHYSICS at your own pace.

This User's Guide takes you step-by-step through every aspect of PHYSICS. Read **Using Physics** for suggestions on how you can start to use the program immediately. You will find many instructions on how to use specific parts of the program within PHYSICS itself; the User's Guide is your reference.

Sensei PHYSICS follows a classic physics curriculum, and has been designed with and tested by educators. PHYSICS is made to complement, supplement, and reinforce textbooks using the special capabilities of the computer.

Introduction

Using This Guide

The guide is divided into several sections.

"Getting Started" explains how to start up the program. It also reviews basic Macintosh commands you will use throughout the program.

"Menus" explains how to use the menus. It shows how to choose a chapter or a subject in that chapter, how to get different kinds of help, including references and hints, and how to use the various features of the program.

"Appendix" lists the subject areas of PHYSICS.

Getting Started

System Requirements

PHYSICS requires a Macintosh 512K Enhanced, Macintosh Plus, Macintosh SE or Macintosh II. If you have ordered two 400K disks, either an external drive or 800K internal drive is required.

Using the Macintosh

Though this manual explains some of the features of the Macintosh, you should be familiar with its basic operation. You should know how to use the Finder™, the mouse, windows, scroll bars, and menus. See *Macintosh*, your owner's guide, for instructions.

This section briefly explains the Macintosh terms used in PHYSICS.

Pointer: A small black arrow is used to "point" or "click" things on the screen. Move the pointer by sliding the mouse across your desk or tabletop.

Mouse: The Mouse is an interface device used with the Macintosh. In PHYSICS, three common mouse activities are:

Clicking: Position the pointer, then quickly press and release the button on the top of your mouse, as though hitting a piano key. Clicking will select and identify objects on the screen, activate buttons, and select menu items.

Getting Started

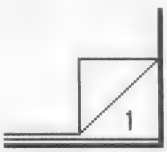
Pressing: Position the pointer, then press and hold down the button on your mouse. This is the method used to operate the scroll bar. Release the mouse button when you are finished scrolling.

Dragging: Position the pointer, then press down the button on your mouse. Holding the button down, move the mouse to a new position. Release the button when you reach your destination.

Menu Bar: The white strip across the top of the screen is the Menu Bar. Open a menu by clicking a title. Drag down when the item you want is highlighted, then release the mouse button. When items on the menu are dimmed, they are not available.

 File Subject Help Options

Page Turner: To turn forward, click in the triangle above the page number in the lower right corner of the page. (For example, on page 1, clicking on the blank triangular page corner will turn to page 2.) If you wish to go from page 2 to page 1, click right on the page number. Pressing steadily will cause the pages to turn rapidly either forward or back.



Getting Started

Windows: Windows allow you to view different parts of the program at the same time, and can be moved around the page by dragging on their top bar.

Buttons: Many of the pages in PHYSICS have buttons that lead to further information or examples. All you need to do is click the button.

Dialog Boxes: Dialog boxes appear when PHYSICS wants to tell you something.

Making a Copy

Start by making a copy of your program disk. You should always use a copy of PHYSICS rather than the original disk. See *Macintosh*, your owner's guide, for instructions.

512K Mac

If you have a 512K Mac with a 400K internal drive and external disk drive, send your disk and the coupon on page 35 to:
Brøderbund Software Direct
P.O. Box 12947
San Rafael, CA 94913-2947

Getting Started

Request the PHYSICS 400K version and Brøderbund will send you two 400K disks.

Hard Disk

If you have a hard disk, create a new folder on the hard disk. Copy the contents of PHYSICS into the new folder. To do this, select all the files *except* the System Folder and drag them over to the hard disk.

400K Disks

If you have two 400K disk drives, and have ordered the 400K format version, copy PHYSICS Disk 1 and PHYSICS Disk 2 onto two single sided floppy disks. Name each disk "Physics Disk 1" and "Physics Disk 2" respectively.

Getting Started

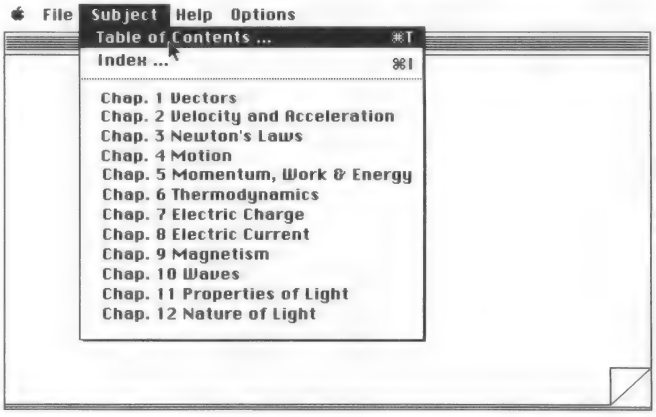
Starting the Program

- The PHYSICS disk is a special master disk. Each time you start PHYSICS with your copy, the Macintosh will ask you to insert your original disk. This is so that the Macintosh can read the identification on the original disk.

- Insert your copy of PHYSICS into the internal drive. Double click the icon called Physics.

  If you have two 400K disks, insert your copy of Physics Disk 1 into the internal drive first. Then insert your copy of Physics Disk 2 into the external disk drive. Double click the icon called Physics.

- When PHYSICS is loaded, click the Subject menu to go to the Table of Contents, to the Index, or to the beginning of any chapter.



Getting Started

Using PHYSICS

PHYSICS is easy to use and adapt to your learning style.

- Make sure you have selected the kind of instruction you want from the Options menu.

  Select the Tutorial command if you want to review or learn material without doing any problems.

  Select the Problems Only command if you only want to practice problems.

  Select the All command if you want the full program: both tutorial and problem pages.

- If you have not saved your place or you wish to start at a new place, go to the Subject menu.

  Select a chapter if you want to see it from its beginning.

  If you want to go to a specific subject, select the Table of Contents or Index command.

Getting Started

- If you need background information for a concept or are stuck on a problem, go to the Help menu.

  The Reference command is available with all options and will take you to the screen that most closely relates to the page or problem on which you are working.

  The Hint command is available when you are working on a problem. It will give you a clue to the answer for that problem.

  The Solution command is available when you are working on a problem. It will give the answer to that problem. However, you must enter the solution yourself to go on to the next problem.

- When you want to stop using PHYSICS, go to the File menu.

  Select the Save Place command if you want to save your place. A desktop icon called Bookmark will appear the next time you insert PHYSICS. Double click on it to go directly to the place you saved, or double click PHYSICS, then use the Restore Place command to take you back to your place.

  Select the Quit command to quit the program without saving your place.

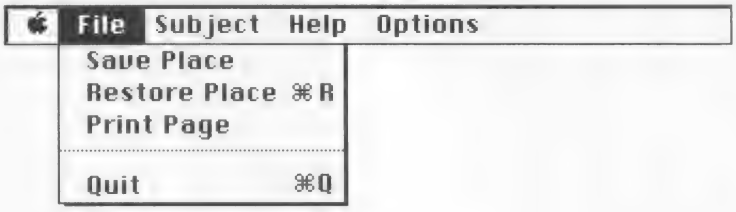
Menus

Apple Menu

The Apple menu contains the calculator and control panel desk accessories. Check your Macintosh manual to see how the control panel and calculator work.

File Menu

The File menu allows you to save and restore your place in the program, and to print pages from PHYSICS.



Save Place

Save Place allows you to save your place in the program. This is useful if you need to leave the program and want to return to the same point in your work. When you have saved your place and quit the program, PHYSICS will make a desktop icon called Bookmark.

Menus

Restore Place

Restore Place restores you to the place you saved when you last exited the program. When returning to PHYSICS, double click Bookmark to go directly to the place you saved, or open PHYSICS, then use the Restore Place command in the File menu. If you wish to start at an entirely new point in PHYSICS, use any of the Subject menu commands.

Print Page

Select Print Page to print the page currently visible on the screen. Any page, including problems, can be printed.

Quit

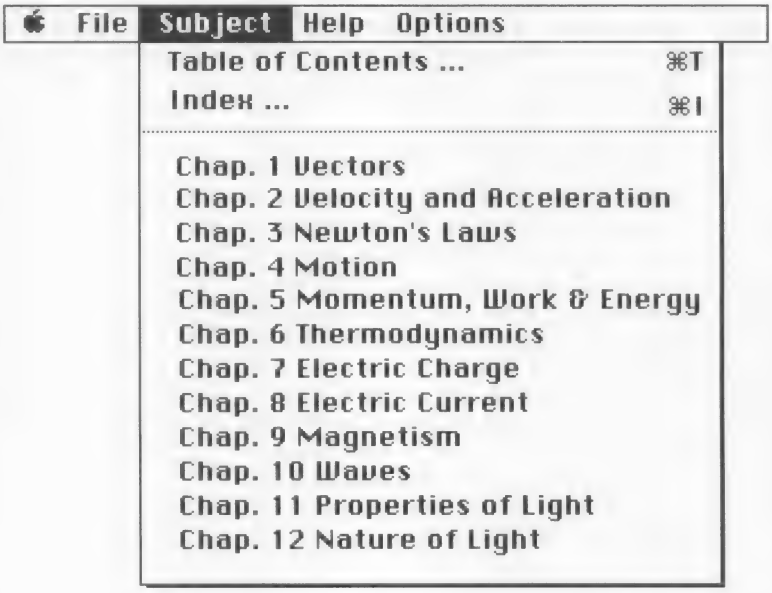
Select Quit to quit the program.

You can use any of the standard Macintosh techniques to eject the disk.

Menus

Subject Menu

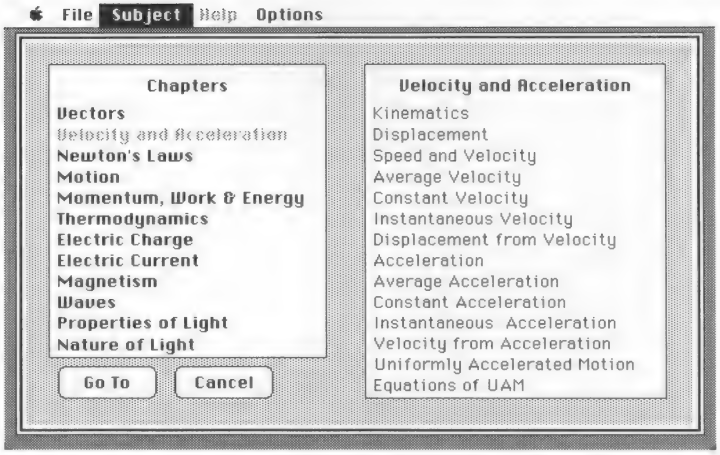
The Subject menu allows you to access any part of PHYSICS. It lists the Table of Contents, the Index and each chapter of PHYSICS.



Menus

Table of Contents

When you select Table of Contents, a dialog box appears. All twelve chapters in PHYSICS are listed in a box on the left.



- Click any chapter and a list of subjects covered in that chapter will appear in the box on the right.
- To go directly to one of those subjects, click on the subject, then click [Go To], or simply double click your selection.
- Clicking [Cancel] sends the Table of Contents away.

Chapters List

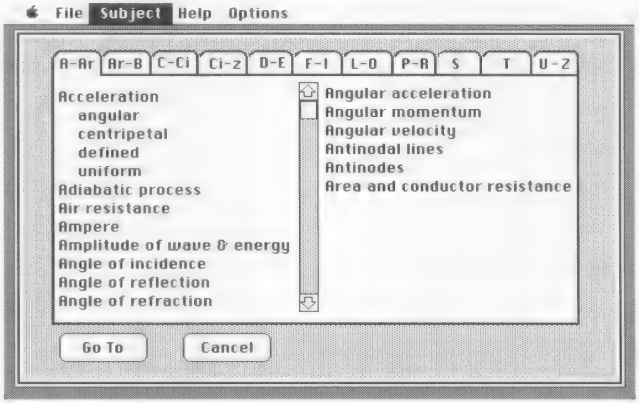
All twelve chapters contained in PHYSICS are also listed in the Subject menu. To go directly to the beginning of any chapter, select that chapter.

Menus

Index

- Use Index to search for specific words or terms. When you select Index, a dialog box appears. In the box is a series of alphabetical "index cards."

- To search for a word or term, click on the tab where the word would be alphabetically listed. To find "ampere," for example, click the tab A-Ar.



- Scroll through the listings of words until you get to the word or term you want.

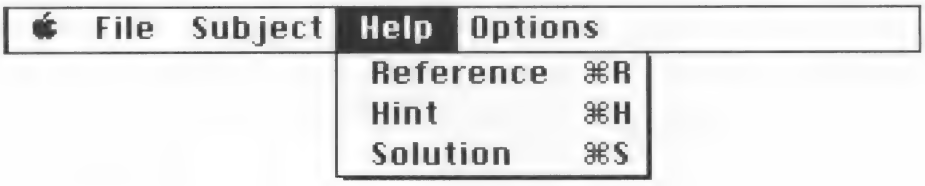
- Click on the term you want, then click [Go To], or just double click your selection.

- To return to the Index, click the Subject menu and select Index again.

Menus

Help Menu

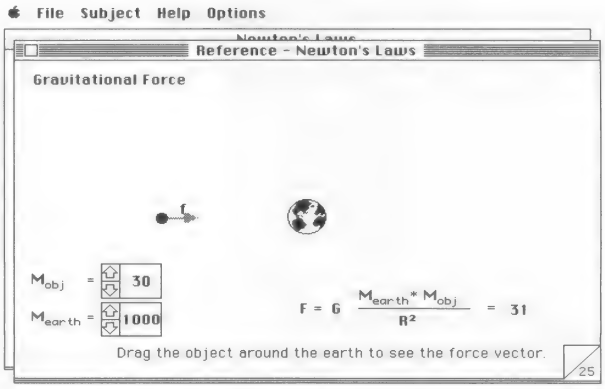
The Help menu offers three categories of assistance: Reference, Hint, and Solution.



Reference

Every page of PHYSICS has a Reference page associated with it. The Reference page is useful if you want background information on the page or problem on which you are working.

- If you select Reference, PHYSICS will show the page that most closely relates to the page on which you are working.



- To look at another page in the section from which the reference comes, you can page forward or backward within the Reference window.

- While the Reference window is active, you can get more information by using Index, Table of Contents, or any chapter from the Subject menu. Click the close box to return to your original page.

- To get rid of the Reference window, click the close box on the upper left corner of the Reference page.

- To see your original page again quickly without getting rid of the Reference window, click on the page (the edge is visible just behind the Reference window). Your page will come forward, and the Reference window will go behind it. To get back to the Reference window, click on its visible portion, and it will come forward.

Hint

Most problems in PHYSICS have a hint associated with them. A hint provides a clue to help you solve the problem on which you are working.

Menus

- To get a hint, pull down the Help menu and select Hint. A Hint dialog box will appear. Click anywhere on the page and the box will go away.

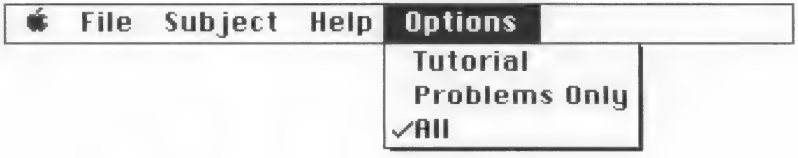
Solution

Solution gives you the answer to the problem you are working on in PHYSICS.

To get the solution, pull down the help menu and select Solution. A dialog box containing the answer to the problem will appear. Click anywhere to make the box go away; enter the answer yourself to advance to the next problem.

Options Menu

Every chapter in PHYSICS is a blend of tutorial sections, exploration pages, and problem sets. You can use these pages separately or together.



Tutorial

The tutorial sections cover the subject material and animations in each chapter; they do not contain problem sets. Select Tutorial, and the program will show only tutorial and animation pages as you move through the program.

Menus

Problems Only

Select Problems Only when you want to do only the problem sets in each chapter. All tutorial sections and animation pages will be skipped as you move through a chapter.

All

When you select All you will be given the complete package - tutorials, animation pages and problem sets - as you move through the chapter.

Appendix

Program Content

The topics covered in each chapter of PHYSICS are outlined below. Animations for each chapter are listed along with their page numbers.

Chapter 1: Vectors

Principal topics covered are:

Laws of Physics
Vectors
Vector addition
Vector components
Adding vector components
Vector subtraction
Multiplying vectors by a scalar

Animations for this chapter:

Page 1 - Chaos
Page 4 - Vector addition
Page 6 - Vector addition
Page 7 - Vector components

Chapter 2: Velocity and Acceleration

Principal topics covered are:

Kinematics
Displacement

Appendix

Speed and velocity
Average velocity
Constant velocity
Instantaneous velocity
Displacement from velocity
Acceleration
Average acceleration
Constant acceleration
Instantaneous acceleration
Velocity from acceleration
Uniformly accelerated motion
Equations of UAM

Animations for this chapter:

Page 5 - Introduction to velocity
Page 7 - Average velocity
Page 9 - Speed, time and displacement
Page 12 - Instantaneous velocity: calculus
Page 13 - Instantaneous velocity
Page 14 - Velocity graph from slope of displacement graph
Page 16 - Displacement: integral of velocity
Page 17 - Changing velocity / displacement
Page 19 - Changing velocity / acceleration
Page 23 - Changing acceleration / velocity
Page 26 - Displacement, velocity and acceleration

Appendix

Chapter 3: Newton's Laws

Principal topics covered are:

Newton's first law
Force and acceleration
Mass and acceleration
Newton's second law: F=MA
Gravitation
Air resistance
Terminal velocity
Newton's third law
Universal gravitation
Law of universal gravitation
Kepler's laws

Animations for this chapter:

Page 1 - Inertia
Page 2 - Force and velocity
Page 3 - Force and acceleration
Page 5 - Mass and velocity
Page 6 - Mass and acceleration
Page 16 - Falling objects
Page 25 - Gravitational force
Page 26 - Motion under gravitational force
Page 28 - Orbital motion and Kepler's Laws

Appendix

Chapter 4: Motion

Principal topics covered are:

Projectile motion
Frames of reference
Circular motion
Centripetal acceleration
Simple harmonic motion
SHM and circular motion
Pendulums
Angular velocity
Angular acceleration
Torque
Rotational inertia
Angular momentum

Animations for this chapter:

Appendix

Chapter 5: Momentum, Work and Energy

Principal topics covered are:

Momentum
Impulse
Conservation of momentum
Work
Kinetic energy
Power
Transfer of kinetic energy
Potential energy
Potential energy and SHM
Gravitational potential energy
Energy in a pendulum
GPE: stable orbit
Binding energy
Mechanical energy

Animations for this chapter:

Appendix

Page 22 - Conservation of kinetic energy
Page 25 - Potential energy
Page 27 - Potential and kinetic energy in SHM
Page 31 - Potential and kinetic energy in SHM (pendulum)
Page 35 - Conservation of total mechanical energy

Chapter 6: Thermodynamics

Principal topics covered are:

Internal energy
Pressure in gases
Temperature in gases
Temperature and pressure
Energy of gas pressure
Weather
Specific heat
Specific heat: metals
Thermodynamics
First law of thermodynamics
Processes in gases
Adiabatic processes
Second law of thermodynamics
Entropy

Appendix

Animations for this chapter can be found on:

Page 1 - Internal energy
Page 2 - Pressure
Page 4 - Temperature, pressure and volume
Page 6 - Gravity: molecular motion

Chapter 7: Electric Charge

Principal topics covered are:

Electric charge
Conductors and insulators
Conduction and induction
Point charges
Coulomb's law
Elementary charge
Electric force on particles
Electric field
Drawing electric field
Lines of force
Electric potential

Animations for this chapter:

Page 2 - Electrostatic charge
Page 10 - Coulomb's law
Page 21 - Electric potential

Appendix

Chaper 8: Electric Current

Principal topics covered are:

Electric current and emf
Potential difference
Ohm's law: resistance
Electric circuits
Resistors in series
Resistors in parallel
Capacitors
Capacitors in series
Capacitors in parallel
Accelerating charged particles
Oscilloscope

Animations for this chapter:

Page 2 - Current in a wire
Page 7 - Resistance in a circuit
Page 19 - Change in electric potential

Appendix

Chapter 9: Magnetism

Principal topics covered are:

Magnetic poles
Magnetic fields
Magnetic flux
Electric current and magnetism
Magnetic force
Magnetic force on particles
Induced emf
Lenz's law
Electric generator
Electric motor
Magnitude of induced emf

Animations for this chapter:

Page 5 - Flux from current
Page 8 - Magnetic force on a wire
Page 15 - Induction
Page 20 - Motors and generators

Appendix

Chapter 10: Waves

Principal topics covered are:

Introduction to waves
Reflection
Refraction
Interference
Standing waves
Waves in two dimensions
Interference in two dimensions

Animations for this chapter:

Page 1 - Waves (frequency, wavelength and amplitude)
Page 2 - Reflection
Page 3 - Transmission/refraction
Page 4 - Interference
Page 5 - Standing waves
Page 6 - Waves in two dimensions
Page 7 - Interference in two dimensions

Appendix

Chapter 11: Properties of Light

Principal topics covered are:

Reflection
Spherical mirrors
Locating images: mirrors
Object-image relations
Convex mirrors
Refraction
Snell's law
Critical angle
Lenses
Converging lenses
Locating images: lenses
Object-image relations
Lensmaker's formula

Animations for this chapter:

Page 3 - Reflection
Page 4 - Parabolic mirrors
Page 6 - Images in a parabolic mirror
Page 8 - Distance and height of image in parabolic mirror
Page 10 - Convex mirror
Page 15 - Refraction
Page 19 - Critical angle
Page 21 - Converging lenses
Page 23 - Images in a lens
Page 24 - Images and objects: proportion in a lens

Appendix

Chapter 12: Nature of Light

Principal topics covered are:

Models of light
Particle model
Wave model
Wave and particle models
Rectilinear propagation
Intensity of illumination
Reflection
Failure of the two models
Refraction: particle model
Refraction: wave model
Diffraction and interference
Photoelectric effect
Complementarity
Synthesis

Animations for this chapter:

Page 13 - Refraction revisited
Page 19 - Quantum Physics

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