Kolbe Academy
Home School

HIGH SCHOOL
PHYSICS WITH LAB
Kinetic Books Principles of Physics

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Kolbe Academy Home School | ♦ SYLLABUS ♦ | Physics High School

COURSE TITLE: Physics with Lab

COURSE TEXTS:

- *Principles of Physics*, Digital Text only, Kinetic Books (T5501),
  - The *Principles of Physics* textbook, Kinetic Books (T5501B) is also available, but emphasis is given that the Digital Text provides is what makes this course homeschool friendly.
- *Principles of Physics* Answer Key and Solution Guide*, Kolbe Academy, Optional
- *Virtual Physics Labs*, Kinetic Books (T5502)
- *Virtual Physics Lab* Answer Key*, Kolbe Academy, Optional
- *Kolbe Academy Guide to Writing a Lab Report* (T5140), Optional

*Kolbe Academy has made available to registered families ONLY the answer key to questions assigned within the scope of the following Kolbe Academy course plan.

Supplemental:

- AP Physics B preparation book for students interested in taking the AP Physics B exam. Local bookstores or libraries generally carry books by Princeton Review and Kaplan. You can find other suggestions at the College Board website: www.collegeboard.com.

COURSE DESCRIPTION:

This course is designed to give an understanding of classical physics. Physics is the science of the natural laws of the physical universe, which, like the natural moral law, flow through creation, having as their origin the goodness of God. "The beauty of creation reflects the infinite beauty of the Creator and ought to inspire the respect and submission of man's intellect and will" *(New Catechism of the Catholic Church* 342).

The honors (H) course is mathematical in nature and includes several math-based physics problems to work as well as conceptual problems. Students interested in taking the Advanced Placement test in Physics (B) would find the Honors track appropriate for preparation. However, the Kolbe Core (K) is conceptual in nature and includes only the more conceptual physics topics and corresponding problems to work within the course plans. It is designed to give the student a general understanding of the concepts in classical physics, but is not appropriate for those students aiming to take the Advanced Placement test for college credit. The Kolbe Core (K) course will give an appropriate background for a student planning on taking any intro or general physics class at a university. Kolbe Academy recommends that Physics be taken by the high school student in 11th or 12th grade after the successful completion of *Intro to Physics and Chemistry* in 8th or 9th, *Biology* in 9th or 10th, and *Chemistry* in 10th or 11th.

SCOPE AND SEQUENCE:

(H) = Honors Physics Students Only

1. Mechanics (Exam I and II)
   a. Motion in 1, 2, and 3 dimensions
   b. Force and Newton's Laws
   c. Work, Energy and Power
   d. Momentum
   e. Uniform Circular Motion
   f. Rotational Mechanics
   g. Rotational Dynamics
   h. Static Equilibrium
   i. Gravity and Orbits
   j. Fluid Dynamics (on Exam III **(H)**)

2. Thermodynamics (Exam III)
   a. Temperature and Heat
   b. Kinetic Theory of Gases
   c. Laws of Thermodynamics

3. Mechanical Waves (Exam IV)
   a. Oscillations and harmonic motion
   b. Wave motion
   c. Sound
   d. Wave superposition and interference

4. Electricity and Magnetism (Exam V)
   a. Electric Charge and Coulomb's Law
   b. Electric Fields
   c. Electric Potential
   d. Electric Flux and Gauss' Law **(H)**
   e. Electric Current and Resistance
   f. Capacitors **(H)**
   g. Direct Current Circuits
   h. Magnetic Fields
   i. Electric Current and Magnetic Fields (on Exam VI **(H)**)
   j. Electromagnetic Induction (on Exam VI **(H)**)

5. Light and Optics (Exam VI)
   a. Electromagnetic Radiation
   b. Reflection
   c. Refraction
   d. Lenses
   e. Interference **(H)**
   f. Diffraction **(H)**

DIPLOMA REQUIREMENTS:

Summa Cum Laude diploma candidates are required to follow either the Kolbe Core course (K) or Kolbe Honors course (H) track outlined in the course plan, and are required to fulfill the laboratory component with this physics course (see page 5). ***Magna Cum Laude*** and ***Standard*** diploma candidates may choose to pursue the (H) or (K) designation, but are not required to do so, and instead have the option of altering the course plan as they choose. ***Summa*** students must complete 4 years of science during their high school course of study including Biology with Lab, Chemistry with Lab, Physics with Lab, and a pre-approved science elective. ***Magna*** students must complete 3 years of science during their high school course of study including Biology, Chemistry, and a physical science. ***Standard*** diploma students must complete 2 years of science including a biological and physical science. Note that this physics course fulfills the physical science requirement for both the *Magna* and *Standard* diplomas. For a student pursuing the ***Magna Cum Laude*** diploma, the science requirement dictates that lab work is incorporated into two of the following three courses: Biology, Chemistry or Physics. There is no lab requirement for the ***Standard*** diploma. Please see below for specific course titles, quarterly reporting requirements and transcript designations for physics.

REQUIRED SAMPLE WORK:

Designation*			**K**	**K**	**H**
Course Title	**Physics**	**Physics w/ Lab**	**Physics**	**Physics w/ Lab**	**Physics w/ Lab**
Quarter 1	1. Any written sample work.	1. Any written sample work. 2. 1 lab report	1. Kolbe Core Exam I	1. Kolbe Core Exam I 2. 1 lab report	1. Kolbe Honors Exam I 2. 1 lab report
Quarter 2	1. Any written sample work.	1. Any written sample work. 2. 1 lab report	1. Kolbe Core Exam II 2. Kolbe Core Exam III	1. Kolbe Core Exam II 2. Kolbe Core Exam III 3. 1 lab report	1. Kolbe Honors Exam II 2. Kolbe Honors Exam III 3. 1 lab report

Quarter 3	1. Any written sample work.	1. Any written sample work. 2. 1 lab report	1. Kolbe Core Exam IV	1. Kolbe Core Exam IV 2. 1 lab report	1. Kolbe Honors Exam IV with 2. 1 lab report
Quarter 4	1. Any written sample work.	1. Any written sample work. 2. 1 lab report	1. Kolbe Core Exam V 2. Kolbe Core Exam VI	1. Kolbe Core Exam V 2. Kolbe Core Exam VI 3. 1 lab report	1. Kolbe Honors Exam V 2. Kolbe Honors Exam VI 3. 1 lab report

***Designation refers to designation type on transcript. K designates a Kolbe Academy Core course. H Designates a Kolbe Academy Honors course.**

If the student wishes to have the course distinguished on the transcript with a (K) as a Kolbe Academy Core course, please be sure to send the correct exams and components each quarter for verification as specified above. **If no designation on the transcript is desired, parents may alter the lesson plan and any written sample work is acceptable to receive credit for the course each quarter.** If you have any questions regarding what is required for the (K) designation or diploma type status, please contact the academic advisory department at 707-255-6499 ext. 5 or by email at advisors@kolbe.org.

COURSE PLAN "AT A GLANCE" OUTLINE:

Core Physics (K)

Quarter 1
- Weeks 1-5: Chapters 1-5
- Week 6: Kolbe Core Exam I
- Week 7-9: Chapters 7-8

Quarter 2
- Weeks 1-3: Chapter 9-13
- Week 4: Kolbe Core Exam II
- Weeks 5-8: Chapters 19-22
- Week 9: Kolbe Core Exam III

Quarter 3
- Weeks 1-4: Chapters 15-18
- Week 5: Kolbe Core Exam IV
- Weeks 6-9: Chapters 23-25, 27

Quarter 4
- Weeks 1-3: Chapters 27 (continued), 29-30
- Week 4: Kolbe Core Exam V
- Weeks 5-8: Chapters 34-37
- Week 9: Kolbe Core Exam VI

Honors Physics (H)

Quarter 1
- Weeks 1-5: Chapters 1-6
- Week 6: Kolbe Honors Exam I
- Week 7-9: Chapters 7-10

Quarter 2
- Weeks 1-3: Chapter 11-13
- Week 4: Kolbe Honors Exam II
- Weeks 5-8: Chapters 14, 19-22
- Week 9: Kolbe Honors Exam III

Quarter 3
- Weeks 1-3: Chapters 15-18
- Week 4: Kolbe Honors Exam IV
- Weeks 5-9: Chapters 23-29

Quarter 4
- Week 1: Chapter 30
- Week 2: Kolbe Honors Exam V
- Weeks 3-8: Chapters 31, 32, 35-39
- Week 9: Kolbe Honors Exam VI

Please note that many chapters are not covered in their entirety. Be sure to refer to the course plan that follows for specific guidance.

COURSE PLAN METHODOLOGY:

The beauty of the Kinetic Books program comes out through the interactive whiteboard applications integrated into the digital textbook. The examples, concepts, and equation demonstrations really bring physics to a new level for home schooled students. Though the course could certainly be done just using the paper bound text, it is highly recommended that students take advantage of the computer based digital textbook and its whiteboard applications. The digital text offers the same benefits that a paper bound text has as students can highlight, enlarge text, and add notes as they read.

The chapters are laid out in the course plan with specific sections assigned. Please pay special care to the assignments, as several topics are skipped both in the Kolbe Core (K) and Kolbe Honors (H) courses because they are beyond the scope of this course. Problems corresponding to each section are also assigned. In the Kolbe Honors (H) course, some of the problems are strictly conceptual in nature while others do require that the student use higher level math skills from Algebra 2 and Trigonometry. The Kolbe Core (K) course concentrates more heavily on the conceptual topics but will also have some math involved. Students may prefer to do all the reading for a chapter prior to attempting the problems, or they may prefer to alternate between reading and doing problems as the course plan suggests.

Most weeks have lab work assigned by using the Virtual Physics Lab or an Interactive Problem in the digital text. To qualify the course as a lab science, students should spend an average of one hour per week doing some type of lab work. Students may receive lab credit by other means than following the course plan suggestions such as a home school co-op, hands-on lab at home, college lab course etc. A separate grade should NOT be given for the lab work, but should be incorporated into the overall grade given for the course. Parents may determine the weight the lab component will have on the final grade, but typical values range from 15-25% of the total grade.

There are 2 sets of exams included with this course plan: one set for the Kolbe Core (K) course and one set for the Kolbe Honors (H) course. Each set includes 6 exams and reflect the content of what is assigned in the weekly course plans. If students do the work assigned during the week, they should be adequately prepared for any question that arrives on the exams. The exams consist of many different types of questions including multiple choice, short answer, and problems. A few of the exam problems are adapted from unassigned problems in the Kinetic Books problems or taken from the Serway Physics texts. Students are not expected to memorize basic equations as they will be provided on the exams. However, they may need to derive certain equations from the given equations in order to solve an exam problem. **Students wishing to receive the Kolbe Core (K) or Kolbe Honors (H) course designation must be sure to use the correct exam set.** Students may not skip or alter questions except when specified by the directions within the exam itself if they wish to receive the (K) or (H) designation for this course. As parents are the primary educator, they may alter the course plan or either set of exams as needed if the student does not desire the (K) or (H) designation on the transcript.

Students interested in preparing for the AP® Physics B exam should follow the Kolbe Honors (H) track. Problems assigned to honors student tend to concentrate more heavily on the topics emphasized in the AP Physics B exam. There are a few *additional* topics not assigned within the Honors track that students preparing for the AP Physics B exam should include in their studies. These are indicated in the course plan, but are summarized for your convenience as follows: Chapters 4.20-4.23, 6.9-6.12, 9.9-9.13, 14.16-14.22, all of chapter 32, chapter 34.13-34.14, 37.22-37.24. 41.0-41.12, 42.0-42.7, 43.0-43.3, 43.5, 43.9-43.10, and 43.13-43.17.

Students can find more information on the correlations between the AP Physics B exam and using the Pr*inciples of Physics* book here: http://www.kineticbooks.com/products/correlations/phys_cor_us_ap.html
Finally, students preparing for the AP Physics B exam should be sure to use an AP Physics prep book. For more information on the AP Physics B exam, go to www.collegeboard.com.

♦♦♦ FIRST QUARTER ♦♦♦

KOLBE ACADEMY WELCOME WEEK	
MON	Read pages 2-5 of the syllabus. Mail in your Online Teacher Access form located at: You will not be able to access any answer keys or solutions to the digital text or virtual lab unless you send this form in. Please note that answer keys and solutions manuals for this course are only available to fully enrolled families or students in single course enrollment.
	Open your access card and follow the instructions. Decide carefully whether you'd like the online access or local access version of the digital text. It is only recommended to do the local access if you have a very slow or limited access to the internet. Keep in mind that the software is only good for 1 year from the date of activation. Take the time to insure that all of the applications and updates you need have been successfully downloaded on your computer.
TUES	Open to Chapter 0, the Introduction. Go through 0.0 to 0.2.
WED	Go through 0.3-0.5
THUR	Go through 0.5-0.7
FRI	Go through 0.8. Using the "Course Plan at a Glance" section on page 4 of this syllabus, take 20 minutes to browse through the table of contents so you will see what chapters you will be covering during your physics course. Look ahead to Week 1. Take stock of the material you will be covering. Make sure you understand what each assignment is and whether it pertains to the course of study you will be following. You are now ready to begin your physics adventure!
Notes	

WEEK 1

When a section is assigned, students should sure to include all of the whiteboard applications in their studies: Concepts, Equations, and Examples. As a general rule of thumb, each section takes at maximum 10 minutes to read straight through, including doing the white board applications. Students may choose to save all the problem assignments until they have completed reading through the entire chapter, or they may follow a reading schedule as follows with the problems interspersed throughout. The quiz should be taken after the student has completed all the problem assignments for the chapter.

This first two weeks will go at a fairly quick pace as it reviews basic units of measurement, mathematical functions and techniques, and introductory physics of motion concepts. Most students should already have these skills in hand from previous coursework so that the pace of the two weeks will not be overwhelming. If this is the student's first attempt at these concepts, the student may benefit from doing the assignments over a an additional week's timeframe.

Kolbe Academy
Home School

♦ COURSE PLAN ♦

Physics
High School

Core Physics (K)

♦♦♦ Chapter 1: Measurement & Math ♦♦♦

1.0-1.8	Read and do whiteboard applications.
Problems	2.1-2.3, 2.6, 3.1-3.5, 5.1, 8.1, 8.2, 8.4, 8.7, 8.10-8.11
1.14, 1.16-1.21	Omit 1.9-1.13 and 1.15. Read and do whiteboard applications.
Problems	17.1-17.3, 18.1-18.4, 19.1
1.23-1.24	Omit 1.22. Use summary to review.
Quiz	Chapter 1 Quizboard: All questions
Problems	C.1, C.2, C.4, C.8, C.10

Important Vocabulary and Concepts for Chapter 1

metric system	SI units
unit prefixes	physical constant
scientific notation	length
time	Pythagorean theorem
mass	radians

Important Equations for Chapter 1

Prefixes	Triangle relationships:
giga (G) = 10^9	$\sin\theta$ = opp/hyp
mega (M) = 10^6	$\cos\theta$ = adj/hyp
kilo (k) = 10^3	$\tan\theta$ = opp/adj
centi (c) = 10^{-2}	Pythagorean Theorem:
milli (m) = 10^{-3}	$a^2 + b^2 = c^2$
micro (m) = 10^{-6}	Angle = θ = s/r
nano (m) = 10^{-9}	360° = 2π radians

Honors Physics (H)

♦♦♦ Chapter 1: Measurement & Math ♦♦♦

1.0-1.9	Read and do whiteboard applications.
Problems	2.1-2.5, 3.1-3.5, 5.1, 8.1, 8.2, 8.4, 8.5, 8.7, 8.10, 8.11, 9.1
1.10-1.16	Read and do whiteboard applications.
Problems	10.1-10.5, 11.2-11.3, 12.2-12.3, 13.2-13.4
1.17-1.22	Read and do whiteboard applications.
Problems	17.1-17.4,18.1-18.4, 19.1, 22.1, A.1
1.23-1.24	Use the summary to review.
Quiz	Chapter 1 Quizboard: All questions
Problems	C.2-C.10

Important Vocabulary and Concepts for Chapter 1

metric system	SI units
unit prefixes	standard
scientific notation	unit conversions
length	trig functions (sin, cos, tan)
time	Pythagorean theorem
mass	radians

Important Equations for Chapter 1

Prefixes	Triangle relationships:
giga (G) = 10^9	$\sin\theta$ = opp/hyp
mega (M) = 10^6	$\cos\theta$ = adj/hyp
kilo (k) = 10^3	$\tan\theta$ = opp/adj
centi (c) = 10^{-2}	Pythagorean Theorem: $a^2 + b^2 = c^2$
milli (m) = 10^{-3}	Angle = θ = s/r
micro (m) = 10^{-6}	360° = 2π radians
nano (m) = 10^{-9}	

♦♦♦ Chapter 2: Motion in One Dimension ♦♦♦

2.0-2.8	Read and do whiteboard applications.
Problems	0.1, 2.2, 2.3, 3.2, 3.4, 4.3-4.5, 4.7, 5.1-5.3, 5.5, 6.2, 7.1, 8.1

Notes

WEEK 2

Core Physics (K)

♦♦♦ Chapter 2: Motion in One Dimension ♦♦♦	
2.0-2.5	Read and do whiteboard applications.
Problems	0.1, 2.2, 2.3, 3.2, 3.4, 4.3-4.5, 5.1-5.3
2.10-2.12	Omit 2.6-2.9. Omit the last three paragraphs of 2.12 and only do whiteboard application Concept 1 in this section. Read and do whiteboard applications.
Problems	10.1, 10.2, 11.2-11.5
2.14-2.16 **2.18-2.19**	Omit 2.13 & 2.17. Read and do whiteboard applications.
Problems	18.1, 18.3, 18.4

Honors Physics (H)

♦♦♦ Chapter 2: Continued ♦♦♦	
2.9-2.16	Read and do whiteboard applications.
Problems	9.1, 9.2, 10.1, 10.2, 11.2-11.5, 11.7, 12.1, 13.1
2.17-2.22	Read and do whiteboard applications.
Problems	18.1, 18.3, 18.4, 18.5, 18.7, 22.1,
2.23-2.26 **2.28-2.29**	Omit 2.27. Read and do whiteboard applications.
Problems	23.1, 23.2, 23.4, 23.7-23.8, 23.11, 25.1, 29.1
2.30-2.31	Use the summary to review.
Quiz	Chapter 2 Quizboard: All questions
Problems	C.2, C.4-C.6, C.9 -C.19
LAB	Virtual Lab: Skee-Ball
♦♦♦ Chapter 3: Vectors ♦♦♦	
3.0-3.3	Read and do whiteboard applications.
Problems	0.1, 1.2, 3.1-3.3
3.4-3.8	Read and do whiteboard applications.
Problems	4.1, 4.2, 4.4, 5.1-5.3, 6.1-6.4

Important Vocabulary and Concepts for Chapter 2

position	velocity
displacement	average velocity
speed	instantaneous velocity
acceleration	free fall acceleration
average acceleration	g = 9.80 m/s^2
instantaneous acceleration	

Important Equations for Chapter 2

$$\bar{v} = \frac{\Delta x}{\Delta t} \qquad v_f = v_i + at$$

$$\bar{a} = \frac{\Delta v}{\Delta t} \qquad \Delta x = v_i t + \frac{1}{2} a t^2$$

$$\Delta x = \frac{1}{2}(v_i + v_f)t \qquad v_f^2 = v_i^2 + 2a\Delta x$$

Notes

Kolbe Academy Home School

♦ COURSE PLAN ♦

Physics High School

WEEK 3

Core Physics (K)

♦♦♦ Chapter 2: Continued ♦♦♦

2.21,2.23 2.26	Omit 2.20, 2.22, 2.24, 2.25, & 2.27-2.29. Read and do whiteboard applications.
Problems	23.1, 23.2, 23.4, 23.7-23.8
2.30-2.31	Use the summary to review.
Quiz	Chapter 2 Quizboard: All questions
Problems	C.2, C.4, C.6, C.7, C.14-C.17
LAB	Virtual Lab: Skee-Ball

Important Vocabulary and Concepts for Chapter 2

position	velocity
displacement	average velocity
speed	instantaneous velocity
acceleration	free-fall acceleration
average acceleration	g = 9.80 m/s^2
instantaneous acceleration	

Important Equations for Chapter 2

$\bar{v} = \frac{\Delta x}{\Delta t}$

$\bar{a} = \frac{\Delta v}{\Delta t}$

$\Delta x = \frac{1}{2}(v_i + v_f)t$

$v_f = v_i + at$

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

$v_f^2 = v_i^2 + 2a\Delta x$

♦♦♦ Chapter 3: Vectors ♦♦♦

3.0-3.4	Read and do whiteboard applications.
Problems	0.1, 1.1-1.3, 3.1-3.3, 4.2-4.4
3.18-3.19	Use the summary to review.
Quiz	Chapter 3 Quizboard: first four questions and last question only, skip the fifth and sixth question
Problems	C.1-C.5

Important Vocabulary and Concepts for Chapter 3

Scalar	Polar notation, $\mathbf{v} = (v, \theta)$
Vector	Rectangular notation, $\mathbf{v} = (v_x, v_y)$

Honors Physics (H)

♦♦♦ Chapter 3: Continued ♦♦♦

3.9-3.15	Read and do whiteboard applications.
Problems	9.1, 9.2, 10.1, 11.1-11.4, 12.1-12.3
3.16-3.17	Read and do whiteboard applications.
Problems	16.1-16.4, 17.1
3.18-3.19	Use the summary to review.
Quiz	Chapter 3 Quizboard: All questions
Problems	C.1, C.2, C.4, C.5, C.6

Important Vocabulary and Concepts for Chapter 3

Scalar	adding and subtracting vectors
Vector	converting from polar to rectangular coordinates and vice versa
Polar notation, $\mathbf{v} = (v, \theta)$	
Rectangular notation, $\mathbf{v} = (v_x, v_y)$	

Important Equations for Chapter 3

$\mathbf{A} + \mathbf{B} = (A_x + B_x, A_y + B_y)$

$r_x = r\cos\theta$

$r_y = r\sin\theta$

$r\sqrt{r_x^2 + r_y^2}$

$\theta = \arctan(r_y / r_x)$

♦♦♦ Chapter 4: Motion in 2 & 3 Dimensions ♦♦♦

4.0-4.3	**Read and do whiteboard applications.**
Problems	0.1, 0.2, 1.1-1.2, 1.4-1.5, 2.1-2.4
4.4-4.6	Read and do whiteboard applications.
Problems	4.1-4.4
4.7-4.10	Read and do whiteboard applications.
Problems	7.1-7.8, 7.10-7.12, 9.1
4.11-4.13	Read and do whiteboard applications.
Problems	11.2-11.4, 13.1
4.14-4.19	Read and do whiteboard applications.
Problems	14.1-14.5,14.7-14.9,14.14, 19.1-19.2

Notes