

High-school Physics (高中物理基础)

Who should take this course?

8th graders or high school students who have taken at least a year of science class but not yet any physics and/or are beginning to take physics this semester. Students should have had at least a year of algebra and geometry, preferably pre-calculus (esp. trigonometry) as well. Some science lab experience will be helpful.

What does this course do?

In most high schools in US, the physics course typically only lasts one year. That is not enough time to cover all the subjects needed, in sufficient depth. So spending more time studying physical concepts and practicing problem-solving skills are going to be very helpful. Physics is an important "fundamental science", which means it forms the basis for many other branches of natural science like chemistry and biology. In addition, many practical applications like engineering and computer-related technology require extensive knowledge of physics. Even from the prospect of mastering math skills, physics is helpful because solving physics problems requires a lot of math concepts and skills. In fact, many high-school math problems *are* physics problems. The primary objectives of this course are:

1. To help students develop a conceptual and mathematical understanding of the physics principles, including classical mechanics, waves, thermodynamics, basic electricity and magnetism, and geometric optics.
2. To apply these principles to analyze and solve problems.
3. To learn how these physics principles relate to everyday life and to apply them in other disciplines like chemistry and biology. Raise students' interest in physics and other related fields.
4. To better prepare students for the physics class in high school and possible AP Physics course(s) and exams(s).

Textbook: *College Physics*, 10th edition by Serway & Vuille (ISBN: 9781285737027)
(Not required)

Alternative book: OpenStax Physics (available online at <https://openstax.org/details/books/physics>)

Reference book: *Conceptual Physics* by Paul G. Hewitt

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Fall 2022 approximate schedule:

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| Week 1 (September 11) | Chapter 1; Math Review |
| Week 2 (September 18) | Chapter 1 continued |
| Week 3 (September 25) | Chapter 2: 1D Kinematics |
| Week 4 (October 2) | Chapter 2 continued |
| Week 5 (October 16) | 1-D Kinematics; Quiz 1 |
| Week 6 (October 23) | Free Fall |
| Week 7 (October 30) | Free Fall continued |
| Week 8 (November 6) | Chapter 4: Newton's Laws of Motion |
| Week 9 (November 13) | Chapter 4 continued |
| Week 10 (November 20) | Chapter 3: Vectors |
| Thanksgiving (no class) | |
| Week 11 (December 4) | Chapter 3 continued |
| Week 12 (December 11) | Projectile Motion |
| Week 13 (December 18) | Projectile Motion and Relative Motion |
| Christmas & New Year holidays (no class) | |
| Week 14 (January 8) | Chapter 4 resumed (Newton's 3 rd law, etc.) |
| Week 15 (January 15) | Incline and Friction |
| January 22, 2022 | Final Exam |

Note: the instructor reserves the right to update or adjust this syllabus at any time.

Spring 2023 tentative schedule:

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| Week 1 (January 29) | §7.4: circular motion |
| Week 2 (February 5) | Chapter 5: Work and Energy |
| Week 3 (February 12) | Chapter 5 continued |
| Week 4 (March 5) | Energy and Power |
| Week 5 | Chapter 9: Solids and Fluids (Density and Pressure) |
| Week 6 | Chapter 10: Thermal Physics I |
| Week 7 | Chapter 11: Thermal Physics II |
| Week 8 | Chapter 11 continued |
| Week 9 | Ideal Gas Law and 1 st Law (§12.1 – 12.3) |
| Week 10 | Chapter 15: Static Electricity I (skip §15.9) |
| Week 11 | Chapter 15 continued |
| Week 12 | Chapter 16: Electric Energy and Potential |
| Week 13 | Chapter 17: Current, Resistance, Ohm's law, Electric energy and power |
| Week 14 | Chapter 13: Vibrations (SHM) |
| Week 15 | Chapter 13 – 14: Waves and Sound |
| Week 16 (June 18) | Final Exam or Presentation |