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 (especially 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 2024 approximate schedule:

Week 1 (September 8)	Chapter 1; Math Review
Week 2 (September 15)	Chapter 1 continued
Week 3 (September 22)	Chapter 2: 1D Kinematics
Week 4 (September 29)	Chapter 2 continued
Week 5 (October 6)	1-D Kinematics; Quiz 1
No class on October 12-13 (Indigenous Peoples' Day weekend)	
Week 6 (October 20)	Free Fall
Week 7 (October 27)	Chapter 4: Newton's Laws of Motion (Newton's 1st and 2nd Law)
Week 8 (November 3)	Chapter 4 continued
Week 9 (November 10)	Chapter 3: Vectors
Week 10 (November 17)	Chapter 3 continued
Thanksgiving (no class on Nov. 24th and December 1st)	
Week 11 (December 8)	Relative Motion
Week 12 (December 15)	Projectile Motion
Christmas & New Year holidays (no class)	
Week 13 (January 5, 2025)	Chapter 4 resumed (Newton's 3rd law, etc.)
Week 14 (January 12)	Incline and Friction
Week 15 (January 19)	§7.4: circular motion
January 26, 2025	**Final Exam**

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

Spring 2025 tentative schedule:

Week 1 (February 2)	Chapter 5: Work and Energy
Week 2 (February 9)	Chapter 5 continued
Week 3 (March 2)	Energy and Power
Week 4	Chapter 6: Momentum and Collisions
Week 5	Chapter 6 continued
Week 6	Chapter 9: Solids and Fluids (Density and Pressure)
Week 7	Chapter 10: Thermal Physics I
Week 8	Chapter 11: Thermal Physics II
Week 9	Chapter 11 continued
Week 10	Ideal Gas Law and 1st Law (§12.1 – 12.3)
Week 11	Chapter 15: Static Electricity I (skip §15.9)
Week 12	Chapter 15 continued
Week 13	Chapter 16: Electric Energy and Potential
Week 14	Chapter 17: Current, Resistance, Ohm's law, Electric energy and power
Week 15	Chapter 13: Vibrations (SHM)
Week 16 (June 22)	**Final Presentation**