General College Physics
Wisconsin Lutheran High School
2024-2025

What is Physics? The world around us is in a state of constant change: the sun and moon rise and set, waves crash, mists rise, rain falls, fires burn, rocks form, and mountains crumble. Amidst all of these changes, there are certain patterns; there is a discernible *order*. In other words: the stars, the seas, the clouds, the rocks, and the earth itself each seem to each have a particular *nature*. Physics is the careful study of the *natures* of things. In fact, the word *physics* literally means "natures" in the Greek language.

General College Physics at WLHS: During the first semester, we will primarily study the science of motion and its relationship to force. Topics include: dimensional analysis, measurement, uncertainty, estimation, 2 dimensional kinematics, projectile motion, newton's laws, force diagrams, centripetal force, circular motion, conservation of energy and momentum, torque, angular momentum, oscillations, and gravity. During the second semester, we will explore a number of inter-related topics including: heat, thermometry, the laws of thermodynamics, electricity, magnetism, optics, electromagnetic induction, radiation, atomic theory, and nuclear physics.

For a detailed overview of the topics we will be covering, refer to the (tentative) calendar on the following pages and also the course website at (www.greatphysics.com). Emphasis on theoretical topics, careful thinking, laboratory experiments, and problem solving makes this course challenging. My aim is to help you succeed in this course, and to have fun while learning physics. So please do not hesitate to contact me with any problems you may run into this semester!

College Credit option: General College Physics is a year-long introductory college-level course for advanced (typically junior or senior level) students at Wisconsin Lutheran High School. It is a dual-credit course offered at Wisconsin Lutheran High School in collaboration with Wisconsin Lutheran College. This means that students enrolled in the course have the option of receiving credit for a four-credit algebra-based laboratory science course from the College.

Advanced Placement credit: While this is not designated specifically as an AP course, students have successfully taken the AP Physics test at the end of the year for college credit.

Course textbook: The course will be organized around a book: the Pocket Guide to accompany Physics for Scientists and Engineers (4th edition) by Serway. (I'll call this PSE for short.) I would highly recommend obtaining a copy of this book. It is inexpensive, compact, and well-written. It will make a very handy addition to your home science library. If you don't want to buy it, I will have copies to loan out for the semester.

Course time and location: The course typically meets during the 8th hour during the academic year in WLHS 223—in the science wing on the first floor of WLHS.

Professor: Dr. Kerry K. Kuehn from Wisconsin Lutheran College (WLC) is the professor for this course. Contact info: kerry.kuehn[at]wlhs.org,

Teaching Assistant contact info: The Wednesday course sections (beginning in September) will be overseen by a teaching assistant. Alyssa Ebeling is an upper-level physics major from Wisconsin Lutheran College. Contact info: alyssa.ebeling[at]wlc.edu

Course websites: In addition to the course information provided through WLHS's *OnCampus* system, we will be also using a website I've designed for this course: www.greatphysics.com/WLHS/

Homework exercises: I will assign weekly homework problems. These are designed to deepen your understanding of lecture material and to prepare you for the quizzes and tests. I do not intend to grade your homework solutions; I will merely give you credit for handing in your best attempt by the due date. Late assignments will receive reduced credit.

Laboratory exercises: Some of our weekly assignments will include laboratory work. Labs will typically take up at least two class periods. Your laboratory notebook pages must be submitted electronically by the assigned date. More details about the required format and expectations will be discussed before the first laboratory period. You will need to order/purchase a dedicated laboratory notebook.

Quizzes: We will have in-class quizzes almost every week on Monday. To prepare for quizzes, you should read the assigned book chapter (at least once), review the lecture material, complete all of the homework problems, and review the homework solutions.

Tests: We will have a midterm exam before the end of the first (and third) quarters and a comprehensive final examination before the end of the second (and fourth) quarters.

Semester Grade components:

Home work and laboratory	20%
Weekly quizzes	30%
Midterm exam	25%
Final exam	25%

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Approximate weekly schedule (including readings, key topics, and laboratory activities):

Week	Serway Textbook Chapter	Key topics and laboratory activities
1 Aug. 12	1: measurement	units, dimensional analysis, uncertainty & estimation
2 Aug. 19	1: measurement	lab experiment: pendular motion
3 Aug. 26	2: motion in 1 dimension	displacement, speed, acceleration, kinematics
4 Sep. 2	3: vectors	lab experiment: kinematics of rolling balls
5 Sep. 9	4: motion in 2 dimensions	vector description of 2d kinematics, circular motion
6 Sep. 16	4: motion in 2 dimensions	lab experiment: projectile motion
7 Sep. 23	5: laws of motion	inertia, force, mass, acceleration, newton's laws
8 Sep. 30	5: laws of motion	problem solving with friction, tension, gravity, drag, buoyancy,
9 Oct. 7	6: circular motion	lab experiment: centripetal force; midterm exam
10 Oct. 14	7: work & energy	work, kinetic energy, work-energy theorem
11 Oct. 21	8: potential energy	potential energy, conservation of energy, power
12 Oct. 28	9: linear momentum	impulse, momentum, collisions, center of mass
13 Nov. 4	10: rigid body rotation	angular velocity, rotational kinematics and energy
14 Nov. 11	11: angular momentum	angular momentum, torque, gyroscopes
15 Nov. 18	12: angular momentum	lab experiment: rotational kinematics
16 Nov. 25	13: statics/elasticity	equilibrium, center of gravity, elasticity
17 Dec. 2	14: oscillations	simple harmonic motion, pendulums, forced oscillations
18 Dec. 9	15: gravitation	kepler's laws, gravitational potential energy, scattering
19 Dec. 16	16: final exam	

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Week	Serway Textbook Chapter	Key topics and laboratory activities
20 Jan. 6	19: Temperature	temperature measurement, thermometry, thermal expansion, ideal gasses
21 Jan. 13	20: Heat and the first law	thermal energy, specific heat capacity, latent heat, the first law of thermodynamics, conduction, convection, and
22 Jan. 20	22: heat engines, entropy and the second law	the second law of thermodynamics, reversible and irreversible processes, engine efficiency, absolute
23 Jan. 27	29: magnetic fields	magnetic poles, earth's magnetic field, magnetic materials, ferromagnetism, paramagnetism, curie temperature
24 Feb. 3	23: electric fields	electric charge, triboelectricity, insulators and conductors, coulomb's law, electric fields
25 Feb. 10	26: capacitance and dielectrics	capacitance, calculation of capacitance, capacitors in series and parallel, energy stored in a capacitor, capacitors with
26 Feb. 17	27: current and resistance	electric current, resistance, resistivity, ohm's law, joule heating
27 Feb. 24	28: direct current circuits	electromotive force, kirchoff's circuit rules, resistors in parallel and series, ammeters and voltmeters, household wiring
28 Mar. 3	28: direct current circuits	DC circuits laboratory, Joule heating, charging and discharging of a capacitor
29 Mar. 10	31: faraday's law	Faraday's law of electromagnetic induction, Lenz's law, eddy currents, electric motors
30 Mar. 17	35: the nature of light and geometric optics	the speed of light, ray approximation, reflection, refraction, dispersion, total internal reflection, prisms and rainbows
31 Mar. 24	35: the nature of light and geometric optics	the speed of light, ray approximation, reflection, refraction, dispersion, total internal reflection, prisms and rainbows
32 Mar. 31	Easter break	
33 Apr. 7	36: geometric optics	images formed by flat mirrors, spherical mirrors, lenses, the thin lens equation, the human eye, telescopes
34 Apr. 14	34: electromagnetic waves	Maxwell, Hertz, and the discovery of electromagnetic waves, production and detection of electromagnetic waves,
35 Apr. 21	37: interference of light waves	young's two slit experiment, soap films, interferometry
36 Apr. 28	38: interference and polarization of light waves	diffraction, polarization, scattering of light
37 May 5	radioactivity	alpha, beta, gamma decay, half life,
38 May 12	42: atomic physics	photoelectric effect, atomic emission spectra, Rutherford, Bohr, and early models of the atom, the hydrogen spectrum,
39 May 19	Review and final exams	