



LINCOLN-WOODSTOCK COOPERATIVE SCHOOL DISTRICT COURSE SYLLABUS

Course Name: AP Physics I

Length: Full Year

Teacher: Katie Parent

Course Description:

AP Physics 1 is an algebra-based, introductory college-level physics course. Students cultivate their understanding of physics through classroom study, in-class activity, and hands-on, inquiry-based laboratory work as they explore concepts like systems, fields, force interactions, change, and conservation.

NGSS Standards Assessed:

HS. Force and Interactions

- **HS-PS2-1.** Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
- **HS-PS2-2.** Use mathematical representations to support the claim that the total momentum of a system of objects is
 - conserved when there is no net force on the system.
- **HS-PS2-3.** Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a
 - macroscopic object during a collision.
- **HS-PS2-4.** Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.
- **HS-PS2-5.** Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and
 - that a changing magnetic field can produce an electric current.

HS. Energy

- **HS-PS3-1.** Create a computational model to calculate the change in the energy of one component in a system when the
 - change in energy of the other component(s) and energy flows in and out of the system are known.
- **HS-PS3-2.** Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a
 - combination of energy associated with the motions of particles (objects) and energy associated with the
 - relative position of particles (objects).
- **HS-PS3-3.** Design, build, and refine a device that works within given constraints to convert one form of energy into
 - another form of energy.



LINCOLN-WOODSTOCK COOPERATIVE SCHOOL DISTRICT

COURSE SYLLABUS

- **HS-PS3-4.** Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system, resulting in a more uniform energy distribution among the components in the system (second law of thermodynamics).
- **HS-PS3-5.** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

HS.Waves and Electromagnetic Radiation

- **HS-PS4-1.** Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
- **HS-PS4-2.** Evaluate questions about the advantages of using digital transmission and storage of information.
- **HS-PS4-3.** Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
- **HS-PS4-4.** Evaluate the validity and reliability of claims in published materials on the effects that different frequencies of electromagnetic radiation have when absorbed by matter. **HS-PS4-5.** Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

HS. Engineering Design

- **HS-ETS1-1.** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
- **HS-ETS1-2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
- **HS-ETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
- **HS-ETS1-4.** Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Anchor Texts or Major Curriculum:

AP® Physics 1: Algebra-Based- Course and Exam Description

<https://apcentral.collegeboard.org/media/pdf/ap-physics-1-course-and-exam-description.pdf>

Course Outline (major units of study):

Unit Title	Essential Question or Overarching Understanding
------------	---



LINCOLN-WOODSTOCK COOPERATIVE SCHOOL DISTRICT

COURSE SYLLABUS

Unit 1- Kinematics	How can the idea of frames of reference allow two people to tell the truth yet have conflicting reports? How can we estimate the height of a very tall building with only a small rock and a stopwatch? Why might it seem like you are moving backwards when a car passes you on the highway? Why is the general rule for stopping your car “when you double your speed, you must give yourself four times as much distance to stop”?
Unit 2- Force and Translational Dynamics	Why do we feel pulled toward Earth but not toward a pencil? Why Is It more difficult to stop a fully loaded dump truck than a small passenger car? Why Is It Difficult To Walk on ice? Why will a delivery truck filled with birds sitting on its floor be the same weight as a truck with the same birds flying around inside?
Unit 3- Work, Energy, and Power	How much money can you save by charging your cell phone at school instead of at home? If energy is conserved, why are we running out of it? Does pushing an object always change its energy? Why does it seem easier to carry a large box up a ramp rather than up a set of stairs?
Unit 4- Linear Momentum	How are the physics definitions of momentum different from how momentum is used to describe things in everyday life? Can a person on an elevator that breaks loose and falls to the ground avoid harm by jumping at the last second? Why will a water balloon break when thrown on the pavement, but not break if caught carefully? Why is it important that cars are designed to include crumple zones?
Unit 5- Torque and Rotational Dynamics	Why does it matter where a door handle is placed?



LINCOLN-WOODSTOCK COOPERATIVE SCHOOL DISTRICT

COURSE SYLLABUS

	Why are long wrenches more effective? What do mobiles have in common with the Grand Canyon Skywalk? Why does a tightrope walker use a long pole?
Unit 6- Energy and Momentum of Rotating Systems	What keeps a bicycle balanced? Why do planets move faster when they travel closer to the sun? What do satellites and projectiles have in common? What do ice skaters do with their arms when they want to spin faster? Why?
Unit 7- Oscillations	How can oscillations be used to make our lives easier and more comfortable? How can an astronaut be "weighed" in space? How could you measure the length of a long string with a stopwatch? Oscillations: What do a child on a swing, a beating heart, and a metronome have in common?
Unit 8- Fluids	Why do some objects float while others sink? Why is an object's ability to float an important characteristic? What implications for our lives would there be if nothing floated? Why don't we feel the miles of air above us pushing us down?

Portrait of a Learner

Independent Learner

I make thoughtful plans and do my best to reach personal goals using feedback to work through challenges.

Responsible Collaborator

I work with others to achieve shared goals by listening actively, contributing ideas, and managing conflict.

Critical Thinker

I analyze information, ask thoughtful questions, and apply reasoning skills to solve problems and make decisions.



LINCOLN-WOODSTOCK COOPERATIVE SCHOOL DISTRICT COURSE SYLLABUS

Effective Communicator

I express ideas clearly, adapting strategies based on the audience, setting, and/or purpose.

Global Citizen

I show that I care and take responsibility by helping in my community and the world around me.

Additional Classroom Expectations: