

South Hadley High School

"A Tradition of Excellence"

We pledge to create a challenging and supportive academic community in which each member strives to develop his/her potential, to become a life-long learner, and to act as a responsible citizen in a diverse and global society.

Accelerated Physics Syllabus

Course Description / Prerequisites
5130 Accelerated Physics (6 credits Full Year)
<i>Prerequisites:</i> A minimum grade of B in Algebra II or IMP III This course is a challenging, mathematically based introduction to physics. The laboratory component of the course is designed to reinforce and enhance the lecture material, providing students with the opportunity to explore physical laws and phenomena themselves rather than relying on theoretical principles. Strong mathematical skills, self motivation and discipline are essential for success in this class.
Course Objectives / Outcomes / Expectations/ Topics
1. Motion and Forces: Newton's laws of motion and gravitation describe and predict the motion of most objects. <ul style="list-style-type: none">• Distinguish between vector quantities (velocity, acceleration, and force) and scalar quantities (speed and mass).• Illustrate how to represent vectors graphically and be able to add them graphically.• Distinguish between, and solve problems involving, velocity, speed, and constant acceleration.• Create and interpret graphs of motion (position vs. time, speed vs. time, velocity vs. time, constant acceleration vs. time).• Explain the relationship between mass and inertia.• Interpret and apply Newton's first law of motion.• Interpret and apply Newton's second law of motion to show how an object's motion will change only when a net force is applied.• Use a free body force diagram with only co-linear forces to show forces acting on an object, and determine the net force on it.• Qualitatively distinguish between static and kinetic friction, what they depend on and their effects on the motion of objects.• Interpret and apply Newton's third law of motion.• Understand conceptually Newton's law of universal gravitation.• Identify appropriate standard international units of measurement for force, mass, distance, speed, acceleration, and time, and explain how they are measured.
2. Conservation of Energy and Momentum The laws of conservation of energy and momentum provide alternate approaches to predict and describe the movement of objects. <ul style="list-style-type: none">• Interpret and provide examples that illustrate the law of conservation of energy.• Provide examples of how energy can be transformed from kinetic to potential and vice versa.• Apply quantitatively the law of conservation of mechanical energy to simple systems.• Describe the relationship among energy, work, and power both conceptually and quantitatively.• Interpret the law of conservation of momentum and provide examples that illustrate it. Calculate the momentum of an object.• Identify appropriate standard international units of measurement for energy, work, power, and momentum.
3. Waves Waves carry energy from place to place without the transfer of matter. <ul style="list-style-type: none">• Differentiate between wave motion (simple, harmonic, nonlinear motion) and the motion of objects (nonharmonic).• Recognize the measurable properties of waves (e.g., velocity, frequency, wavelength) and explain the relationships among them.

- Distinguish between transverse and longitudinal waves.
- Distinguish between mechanical and electromagnetic waves.
- Interpret and be able to apply the laws of reflection and refraction (qualitatively) to all waves.
- Recognize the effects of polarization, wave interaction, and the Doppler Effect.
- Explain, graph, and interpret graphs of constructive and destructive interference of waves.
- Explain the relationship between the speed of a wave (e.g., sound) and the medium it travels through.
- Recognize the characteristics of a standing wave and explain the conditions under which two waves on a string or in a pipe can interfere to produce a standing wave.

4. Electromagnetism

Stationary and moving charged particles result in the phenomena known as electricity and magnetism.

- Recognize the characteristics of static charge, and explain how a static charge is generated.
- Interpret and apply Coulomb's law.
- Explain the difference in concept between electric forces and electric fields.
- Develop a qualitative and quantitative understanding of current, voltage, resistance, and the connection between them.
- Identify appropriate units of measurement for current, voltage, and resistance, and explain how they are measured.
- Analyze circuits (find the current at any point and the potential difference between any two points in the circuit) using Kirchoff's and Ohm's laws.

5. Electromagnetic Radiation

Oscillating electric or magnetic fields can generate electromagnetic waves over a wide spectrum of energies.

- Describe the electromagnetic spectrum in terms of wavelength and energy, and be able to identify specific regions such as visible light.
- Explain how the various wavelengths in the electromagnetic spectrum have many useful applications such as radio, television, microwave appliances, and cellular telephones.
- Calculate the frequency and energy of an electromagnetic wave from the wavelength.

Recognize and explain the ways in which the direction of visible light can be changed.

Students should understand the following by the end of this course:

- Kinematics in one, two, and three dimensions
- Vectors
- Dynamics: Force and motion
- Circular motion
- Gravity
- Work and energy
- Momentum
- Bodies in equilibrium
- Vibrations, waves, and sound
- Electromagnetic waves
- Light and geometric optics
- Electricity including simple circuits

South Hadley High School's Learning Expectations

- LE 1: Read, write, and communicate effectively
- LE 2: Define, analyze, and solve complex problems and communicate results
- LE 3: Study and work productively both independently and in groups
- LE 5: Acquire, apply, integrate, analyze and synthesize knowledge

Text and Resources Required

- *Physics: Principles with Applications, third edition* by Giancoli (1991)

Grading / Assessment Policy / Homework / Make-Up / Extra Help

- Tests/quizzes (50%), Labs (40%), and Homework (10%)
- Extra help is available on an as-needed basis
- Quizzes may be made up; tests may only be made up at the discretion of the instructor

Attendance / Behavior / Academic Honesty

- *See student handbook*