Honors Physics - Overview

Content Area: **Science**
Course(s): **PHYSICS H**
Time Period:
Length: **N/A**
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Cover

EAST BRUNSWICK PUBLIC SCHOOLS

East Brunswick New Jersey

Superintendent of Schools

Dr. Victor P. Valeski

Science

Honors Physics

Course Number: 1134

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Course Adoption: 4/21/1986

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Course Overview

Honors Physics provides a rigorous mathematical study of physics using algebra and trigonometry. Mathematical and graphical methods of vector analysis are used to describe and analyze the dynamics of the physical phenomena. During numerous laboratory experiences, students collect lab data and use mathematical, physical, and computational tools to build models, pose and refine theories, and find relationships between science concepts. Laboratory experiences are used to introduce concepts using inquiry, as well as reinforce student understanding. Students frequently design their own lab procedures to solve a problem. Critical analysis of data and problem solving related to physical phenomena are the major skills developed in this course. Honors Physics is a course for students who may be considering a science-related career.

Prerequisites for this course are: Academic or Honors Chemistry and Algebra II. Students are assigned a summer assignment to be completed prior to starting this course.

This course is a dual-enrollment course with Middlesex County College, where students can earn 8 credits for General Physics I and II with labs (PHY-123, 125, 124, 126).

Modifications

Each teacher, each student, each classroom is unique and adaptations are specific to each situation. Differentiating instruction and providing multiple ways to assess allows more flexibility for students to meet the standards and requirements of the class. Below are samples of the types of adaptations/modifications that may occur for students based on need including ELLs, students with a 504 Plan, Special Education, Basic Skills and Gifted and Talented students.

Adaptations/Modifications:

Input	Output	Time
Adapt the way instruction is delivered to the learner. ***For example:*** • Use different visual aids, • Plan more concrete examples, • Provide hands-on activities, • Place students in cooperative groups.	Adapt how the learner can respond to instruction. ***For example:*** • Allow a verbal vs. written response, • Use a communication book for students, • Allow students to show knowledge with hands-on materials.	Adapt the time allotted and allowed for learning, task completion or testing. ***For example:*** • Individualize a timeline for completing a task, • Pace learning differently (increase or decrease) for some learners.
Difficulty	**Level of Support**	**Size**

Adapt the skill level, problem type, or the rules on how the learner may approach the work. ***For example:*** • Simplify task directions. • Use of calculator.	Increase the amount of personal assistance with specific learner. ***For example:*** • Assign peer buddies, teaching assistants, peer tutors or cross-age tutors.	Adapt the number of items that the learner is expected to learn or complete. ***For example:*** • Reduce the number of vocabulary words a learner must learn at any one time.
Degree of Participation Adapt the extent to which a learner is actively involved in the task. ***For example:*** • Allow for small group/individual presentations vs. presentations to the whole class.	**Alternate Goals** Adapt the goals or outcome expectations while using the same materials. ***For example:*** • Students in the same class are expected to either write a paragraph, write a bulleted response, or meet with the teacher to provide a verbal response.	**Substitute Curriculum** Provide differentiated instruction and materials to meet a learner's individual goals. ***For example:*** • Individualize a timeline for completing a task, pace learning differently (increase or decrease) for some learners, • Use of Learning Ally.

Materials and Resources

Physics

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Author: Douglas Giancoli

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Content Specific Standards

SCI.HS.PS1.A	Structure and Properties of Matter
SCI.HS.PS2.A	Forces and Motion
SCI.HS.PS2.B	Types of Interactions
SCI.HS.PS3.A	Definitions of Energy
SCI.HS.PS3.B	Conservation of Energy and Energy Transfer
SCI.HS.PS3.C	Relationship Between Energy and Forces

SCI.HS.PS3.D	Energy in Chemical Processes
SCI.HS.PS4.A	Wave Properties
SCI.HS.PS4.B	Electromagnetic Radiation
SCI.HS.PS4.C	Information Technologies and Instrumentation
SCI.HS.ESS1.A	The Universe and Its Stars
SCI.HS.ESS1.B	Earth and the Solar System
SCI.HS.ESS2.A	Earth Materials and Systems
SCI.HS.ESS2.D	Weather and Climate
SCI.HS.ETS1.A	Delimiting Engineering Problems
SCI.HS.ETS1.A	Defining and Delimiting Engineering Problems
SCI.HS.ETS1.B	Developing Possible Solutions
SCI.HS.ETS1.C	Optimizing the Design Solution
SCI.HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.
SCI.HS-ESS1	Earth's Place in the Universe
SCI.HS-ESS2-4	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
SCI.HS-ESS2	Earth's Systems
SCI.HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
SCI.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.
SCI.HS-ETS1	Engineering Design
SCI.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.
SCI.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.
SCI.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.
SCI.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.
SCI.HS-PS2	Motion and Stability: Forces and Interactions
SCI.HS-PS4-1	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.
SCI.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.
SCI.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.
SCI.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.

SCI.HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
SCI.HS-PS4	Waves and Their Applications in Technologies for Information Transfer
SCI.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.
SCI.HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
SCI.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.
SCI.HS-PS3	Energy
SCI.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.
SCI.HS-PS4-2	Evaluate questions about the advantages of using a digital transmission and storage of information.
SCI.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).
SCI.HS-PS1-3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
SCI.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.
SCI.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.
SCI.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.
SCI.HS-PS4-4	Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.
	Planning and Carrying Out Investigations
	Using Mathematics and Computational Thinking
	Analyzing and Interpreting Data
	Stability and Change
	Cause and Effect
	Developing and Using Models
	Scale, Proportion, and Quantity
	Systems and System Models
	Asking Questions and Defining Problems
	Patterns
	Engaging in Argument from Evidence
	Constructing Explanations and Designing Solutions
	Energy and Matter
	Obtaining, Evaluating, and Communicating Information

Structure and Function

Interdisciplinary Standards

LA.RST.9-10.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.9-10.2	Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
LA.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
LA.RST.9-10.5	Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
LA.RST.9-10.6	Determine the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
LA.RST.9-10.7	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
LA.RST.9-10.8	Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
LA.RST.9-10.9	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
LA.WHST.9-10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant sufficient textual and non-textual evidence.
LA.WHST.9-10.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.9-10.3	(See note; not applicable as a separate requirement)
LA.WHST.9-10.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.WHST.9-10.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
LA.WHST.9-10.6	Use technology, including the Internet, to produce, share, and update writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically.
LA.WHST.9-10.7	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
LA.WHST.9-10.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

LA.WHST.9-10.9	Draw evidence from informational texts to support analysis, reflection, and research.
LA.WHST.9-10.10	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
MA.K-12.1	Make sense of problems and persevere in solving them.
MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.4	Model with mathematics.
MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.K-12.8	Look for and express regularity in repeated reasoning.

21st Century Life and Career Ready Practice Standards

CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
CRP.K-12.CRP3.1	Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.
CRP.K-12.CRP4.1	Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.
CRP.K-12.CRP5.1	Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.
CRP.K-12.CRP6.1	Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their

	organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.
CRP.K-12.CRP7.1	Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.
CRP.K-12.CRP8.1	Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
CRP.K-12.CRP9.1	Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.
CRP.K-12.CRP10.1	Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.
CRP.K-12.CRP11.1	Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.
CRP.K-12.CRP12.1	Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Technology Standards

TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.B	Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
TECH.8.1.12.C	Communication and Collaboration: Students use digital media and environments to

	communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.12.D	Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.12.F	Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
TECH.8.2.12	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.12.A	The Nature of Technology: Creativity and Innovation: Technology systems impact every aspect of the world in which we live.
TECH.8.2.12.B	Technology and Society: Knowledge and understanding of human, cultural and society values are fundamental when designing technology systems and products in the global society.
TECH.8.2.12.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.12.D	Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.
TECH.8.2.12.E	Computational Thinking: Programming: Computational thinking builds and enhances problem solving, allowing students to move beyond using knowledge to creating knowledge.

Pacing Guide

Marking Period 1		
Topic	**Pacing**	**Assessment Examples**
1D Kinematics	7-8 Blocks divided into sub-topics such as: • graphing • constant velocity vs. accelerated motion, • kinematics equations • practice with those equations	Summer Assignment Quiz Graphing Quiz Using Equations in solving problems quiz? Unit test Graphing lab assessment
2D Kinematics	4-5 blocks divided into sub-topics such as: • Factors affecting range, time of flight, and maximum height • Independence of motion in multiple dimensions • Applying equations to	Unit test Lab assessment (Planning, graphing, or error) Conceptual projectile quiz

	real-world scenarios	
Dynamics	9-10 blocks divided into sub-topics such as: • Free body diagrams • Calculating forces • Systems in equilibrium • Accelerating systems • 2D systems	FBD quiz Force equations quiz Planning Lab Assessment Unit test

Marking Period 2		
Topic	**Pacing**	**Assessment Examples**
Circular motion	5-6 blocks divided into sub-topics such as: • Identifying situations with centripetal force • Rotational kinematics • Banked curves • Gravitational fields Gravitational forces (large scale	Unit test
Work and Energy	6 Blocks divided into sub-topics such as: • Work • Net work and kinetic energy • Potential Energy • Conservation of energy	Work Quiz Lab assessment Concept energy quiz Unit test
Simple Harmonic Motion	5 blocks divided into sub-topics such as: • SHM graphs • Spring and pendula shm • Resonance	SHM qualities quiz SHM test
Impulse and Momentum	7 blocks divided into sub-topics such as: • Impulse • Conservation of momentum • 2D collisions • Momentum and energy	Impulse quiz 2D quiz Momentum test Lab assessment

	• Center of Mass	

Marking Period 3		
Topic	**Pacing**	**Assessment Examples**
Rotation (including kinematics, dynamics, energy, and momentum)	10 Blocks divided into sub-topics such as: • Torque • Moment of inertia • Newton's second law • Rotational kinetic energy • Angular momentum	Torque quiz torque/MOI/Newton's second law quiz Energy and Momentum quiz
Gravitation	5 Blocks divided into sub-topics such as: • Review universal gravitational force and fields • Gravitational potential energy	Gravitation quiz
Electrostatics	7 Blocks divided into sub-topics such as: • Behavior of charge • electroscopes • Coulombs law • Electric fields	Behavior of charge quiz Forces and fields test
Electric potential energy, Electric potential, Capacitor concepts	7 Blocks divided into sub-topics such as: • Potential (uniform and non-uniform fields • Potential energy (uniform and non-uniform fields • Capacitors	Potential and energy quiz Lab assessment Unit test
DC Circuits	8 Blocks divided into sub-topics such as: • Ohms laws with current, resistance, and voltage • Series and parallel circuits • Network circuits • Series and parallel capacitors	Series and parallel quiz Complex circuit quiz Lab assessment Circuits test
Magnetism and electromagnetism	10 Blocks divided into sub-topics such as:	RHR quiz

	• Magnetic fields • Magnetic force on a moving charge • Magnetic force on a wire • Magnetic field of a straight wire • Magnetic field of circular wires • Torque on a loop of wire	Magnetic Forces quiz Magnetism Test
Electromagnetic induction	6 Blocks divided into sub-topics such as: • Faraday ‘s Law • Lenz’s Law • Motional EMF	Faraday Test Lab assessment

Marking Period 4		
Topic	**Pacing**	**Assessment Examples**
Waves	11 Blocks divided into sub-topics such as: • Waves basics • Resonance • Standing waves on strings • Standing waves in tubes • Doppler effect Takes place during AP’s - extra blocks in there to account for multiple absences.	Waves and standing waves quiz Waves Test
Physical Optics	6 Blocks divided into sub-topics such as: • Diffraction gratings • Double slit diffraction • Thin-film interference (time dependent)	Physical optics test
Geometric Optics	8 Blocks divided into sub-topics such as: • Straight mirrors • Curved mirrors • Snell’s law • Thin lens	Mirror quiz Refraction quiz Optics test Lab assessment
Engineering task	3 Blocks	Rubric for engineering task

Formative and Summative Assessment

Teachers ultilize a variety of methods for assesment including:

	Unit Tests and Quizzes	**Labs, Projects & Classwork**	**Lab Assessments**	**Homework**
Category Criteria	Individual assessments based on specific or general content knowledge.	Any group work primarily completed in class to be checked and/or graded for completion.	Individual assessments based on group lab work. Lab data and other notes may sometimes be used.	Any work assigned to be completed outside of the classroom.

All students take a common Midterm and Final Exam.

Grading and Evaluation Guidelines

Marking period grades for Honors Physics will be determined using the following weighting:

- Tests, quizzes: 60%
- Labs: 25%
- Assignments (homework and classwork): 15%

A point system is used within each grading category so that assessments with a higher point value make a more significant contribution to that category's grade. The final grade for the course is a weighted average of the four marking period grades and exams (midterm and final). The following weightings are used in this calculation:

- Marking period 1: 20%
- Marking period 2: 20%
- Midterm exam: 10%
- Marking period 3: 20%
- Marking period 4: 20%
- Final exam: 10%

The content, teaching strategies, common assessments, and student results for this course are evaluated annually.

Other Details

Course Number: 1134

School where class is offered: East Brunswick High School

Grade level: 10-12

03152 Physics—Advanced Studies (Honors)
Usually taken after a comprehensive initial study of physics, Physics—Advanced Studies courses provide instruction in laws of conservation, thermodynamics, and kinetics; wave and particle phenomena; electromagnetic fields; and fluid dynamics