Pequannock Township School District Curriculum Syllabus

Academic Physics - Grade 11/12

Course Description:

This course represents a comprehensive full year of Algebra-based Physics. The course is divided into two main units. The first unit is comprised of Mechanics which encompasses the motion of bodies subjected to forces exerted on them. The second unit is Electricity and Magnetism which includes electric and magnetic fields and forces as well as the relationship between electric current, resistance, and voltage. A third component of the course investigates Simple Harmonic Motion, Waves, Light and the Bohr model of the Hydrogen atom.
The sequence of topics has been designed to use and reinforce the mathematics that students are studying. Connections are also developed between the analysis of motion and graphical analysis, collision problems, and the solving of systems of equations.

Course Scope, Sequence and Standards:

The following is a list of NJSLS that describe what students are expected to know and be able to do as a result of successfully completing this course. The following NJSLS are the basis of the assessment of student achievement. The learner will demonstrate mastery of:

Unit of Study	NJSLS-Science Standards	Unit Description	Quarter
Unit Plan 1: Kinematics	HS-PS2-1, HS-PS2-2, HS-PS2-3, HS-ETS1-2, and HS-ETS1-3.	Students are expected to plan and conduct investigations, analyze data and use math to support claims, and apply scientific ideas to solve design problems in order to develop an understanding of ideas related to why objects move with specific speed/velocity and how time affects an object's rate of acceleration. They will utilize scalar and vector quantities to solve problems using the four kinematics equations to investigate the relationships between velocity, distance, time, and acceleration. Students are also able to apply science and engineering ideas to design, evaluate, and refine experiments to determine the velocity, time, and distance travelled of an object using basic laboratory equipment and materials. The crosscutting concepts of patterns, cause and effect, and systems and systems models are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in planning and conducting investigations, analyzing data and using math to support claims, and applying scientific ideas to solve design problems	Q1

		and to use these practices to demonstrate an understanding of the core ideas.	
Unit Plan 2: Dynamics	HS-PS2-1, HS-PS2-2, HS-PS2-3, HS-ETS1-2, and HS-ETS1-3.	In this unit of study, students are expected to plan and conduct investigations, analyze data and using math to support claims, and apply scientific ideas to solve design problems students in order to develop an understanding of ideas related to why some objects keep moving and some objects fall to the ground. Students will also build an understanding of forces and Newton's second law. They will represent the applied forces on an object within a coordinate system through the use of free body diagrams. Students are also able to apply science and engineering ideas to design, evaluate, and refine a device to minimize the effects of frictional force on a macroscopic object in motion. The crosscutting concepts of patterns, cause and effect, and systems and systems models are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in planning and conducting investigations, analyzing data and using math to support claims, and applying scientific ideas to solve design problems and to use these practices to demonstrate an understanding of the core ideas.	Q1
Unit Plan 3: Uniform Circular Motion (UCM)/Universal Gravitation (UG)	HS-ESS1-4 and HS-PS2-4.	In this unit of study, students use mathematical and computational thinking to examine the processes governing the workings of the solar system and universe. They will also relate the radius of a circle and the speed or rate of revolution a particle to the magnitude of its centripetal acceleration. The crosscutting concepts of scale, proportion, and quantity are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in using mathematical and computational thinking and to use this practice to demonstrate understanding of core ideas.	Q1
Unit Plan 4: Work and Energy	HS-PS3-2, HS-PS3-1, HS-PS3-3, HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, and HS-ETS1-4.	In this unit of study, students develop and use models, plan and carry out investigations, use computational thinking and design solutions as they make sense of the disciplinary core idea. The disciplinary core idea of Energy is broken down into subcore ideas: definitions of energy, conservation of energy and energy transfer, and the relationship between energy and forces. Energy is understood as a quantitative property of a system that depends on the motion and interactions of matter, and the total change of energy in any system is equal to the total energy transferred into and out of the system. Students also demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conversion of energy. The crosscutting concepts of cause and effect, systems and systems models, energy and matter, and the influence of science, engineering, and technology on society and the natural world are further developed in the performance expectations. Students are expected to demonstrate proficiency in developing and using models, planning and carry out investigations, using computational thinking and designing solutions, and they are expected to use these practices to demonstrate understanding of core ideas.	Q2
Unit Plan 5:	HS-PS2-1, HS-PS2-2, HS-PS2-3, HS-PS2-4,	In this unit of study, students develop and use models, plan and carry out investigations, use computational thinking and design solutions as they make sense of the disciplinary core idea. The disciplinary core idea of momentum is the conservation of momentum and energy transfer under	Q2

Momentum	HS-PS2-5, HS-ETS1-1, HS-ETS1-3.	certain conditions, and the relationship between impulse and and change in momentum. Momentum is understood as a property of a system that depends on the mass and velocity of matter, and the total change of momentum in a system is conserved when there is no net external force. Students also demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conservation of momentum. The crosscutting concepts of cause and effect, systems and systems models, energy and matter, and the influence of science, engineering, and technology on society and the natural world are further developed in the performance expectations. Students are expected to demonstrate proficiency in developing and using models, planning and carry out investigations, using computational thinking and designing solutions, and they are expected to use these practices to demonstrate understanding of core ideas.	
Unit Plan 6: Electric Charge and Electric Field	HS-PS2-4.	In this unit of study, students' understanding of how forces at a distance can be explained by fields, why some materials are attracted to each other while others are not, how magnets or electric currents cause magnetic fields, and how charges or changing magnetic fields cause electric fields. The crosscutting concept of cause and effect is called out as an organizing concept. Students are expected to demonstrate proficiency in planning and conducting investigations and developing and using models.	Q2
Unit Plan 7: Electric Potential	HS-PS2-4.	In this unit of study, students' understanding of how forces at a distance can be explained by fields, why some materials are attracted to each other while others are not, how electric potential, voltage and potential energy are related to one another, how charged objects respond to electric fields, and how the configuration of equipotential lines reflects change in voltage and size of the electric field. The crosscutting concept of cause and effect is called out as an organizing concept. Students are expected to demonstrate proficiency in planning and conducting investigations and developing and using models.	Q3
Unit Pan 8: Electric Currents and Circuits	HS-PS3-3 and HS-PS3-5.	In this unit of study, students demonstrate an understanding of the relationship between current, voltage, and resistance and the application of Ohm's Law to find these quantities in series and parallel circuits. They will assess DC circuits to identify their components to be in series or parallel and utilize laboratory equipment to measure and record voltage and current within each type of circuit. The crosscutting concept of cause and effect is called out as an organizing concept. Students are expected to demonstrate proficiency in planning and conducting investigations and developing and using models.	Q3
Unit Plan 9: Magnetism	HS-PS2-5 and HS-PS3-5.	In this unit of study, students' understanding of how forces at a distance can be explained by fields, why some materials are attracted to each other while others are not, how magnets or electric currents cause magnetic fields, and how charges or changing magnetic fields cause electric fields. The crosscutting concept of cause and effect is called out as an organizing concept. Students are expected to demonstrate proficiency in planning and conducting investigations and developing and using models.	Q3

Unit Plan 10: Electromagnetic Induction	HS-PS2-5 and HS-PS3-5.	In this unit of study, students understand constant magnetic field and a moving loop of wire will result in a current and a changing magnetic field and a stationary loop of wire will result in a current, Faraday's Law of Induction which states that the induced EMF in a wire loop is proportional to the rate of change of Magnetic Flux through the loop, and Lenz's Law which explains that the direction of the induced EMF in a current loop is such that the resulting current produces a magnetic field that resists the change of flux through the loop. The crosscutting concept of cause and effect is called out as an organizing concept. Students are expected to demonstrate proficiency in planning and conducting investigations and developing and using models.	Q3
Unit Plan 11: Simple Harmonic Motion, Vibrations, and Waves	HS-PS4-1.	In this unit of study, students apply their understanding of how wave properties can be used to transfer information across long distances, store information, and investigate nature on many scales. Students will demonstrate an understanding of how oscillations and wave properties are applicable in mechanical and electrical devices.	Q4
Unit Plan 12: Electromagnetic Waves and Optics	HS-PS4-3, HS-PS4-4, HS-PS4-5, HS-ETS1-1, HS-ETS1-3, and HS-PS4-2.	In this unit of study, students apply their understanding of how wave properties can be used to transfer information across long distances, store information, and investigate nature on many scales. The crosscutting concept of cause and effect is highlighted as an organizing concept for these disciplinary core ideas. Students are expected to demonstrate proficiency in using mathematical thinking, and to use this practice to demonstrate an understanding of the core idea.	Q4
Unit Plan 13: Atomic and Nuclear Physics	HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, and HS-ETS1-4.	In this unit of study, students construct explanations for the principles of modern physics including nuclear structure and energy levels, radioactivity and the decay of isotopes, and nuclear reactions. Students will demonstrate understanding of these principles through their applications of nuclear fusion, fission, and half-life to the design and development of nuclear power plants and radiometric dating. They will investigate the various experiments leading to these discoveries including the contributions of Max Planck, Ernest Rutherford, and Robert Millikan as well as the models and unifying theories establishing the connections between quantum dynamics and electromagnetism. Students demonstrate proficiency in developing and using models, constructing explanations, and engaging in argument from evidence. The crosscutting concepts of stability and change, energy and matter, and patterns are called out as organizing elements of this unit.	Q4

Assessments

Evaluation of student achievement in this course will be based on the following:

Assessment Types

a. *Lab, Reading Concept Checks, Homework Concept Checks, Unit Exams.*

b. ***Labs***

*All lab work and lab reports will be done **legibly** inside your Quadruled composition lab notebook during your lab block using pencil, no typed labs. Your lab notebook will be submitted at the end of the lab period and returned to you at the start of the next lab day.*

Labs do not go home to be completed. Labs may require 1, 2 or 3 lab periods to complete depending on the complexity of the experiment.

Assessment Policy
Each assignment is assigned a certain number of points, which varies. The Final Grade is determined by Number of Points Earned Divided by Total Points.

Curriculum Resources

Textbook: *Glencoe Science - Physics: Principles and Problems*

Home and School Connection

The following are suggestions and/or resources that will help parents support their children:

Solve assigned practice problems and complete question packets for every unit.

Invest in study/review time on a daily basis.

Online video resources by unit - Bozeman Science, Khan Academy

PhET Simulations to reinforce theory and model concepts