Rumson-Fair Haven Regional High School

Course: *Physics Honors*
Staff Writers: Erika Waltz and Alex Cafiero
Supervisor: Jon Pennetti
Approved: August 2024

Section I: Course Description

The *Physics Honors* curriculum is designed specifically for our 9th-grade students who are concurrently enrolled in Geometry Honors. The goal is to provide a robust foundation in both conceptual understanding and enhanced mathematical computational skills within the realm of physics. Throughout this laboratory course, students will explore and comprehend the fundamental principles of physics while applying advanced concepts from Algebra I. The *Physics Honors* curriculum goes beyond state standards, ensuring a thorough grasp of the subject matter. The cover will cover mechanics, energy, wave motion, electricity, and magnetism. Students will be expected to use advanced mathematical processes to investigate vectors while applying geometric and trigonometric principles to physical situations. An in-depth look at two-dimensional motion and forces will be included (which is the biggest departure from the *Physics* curriculum). Assessments will include tests, quizzes, lab reports, and projects. Students are expected to effectively create lab reports and use detailed data analysis to confirm their experimental results. Labs will run once every four-day schedule rotation.

Section II: NJSLS: New Jersey Student Learning Standards/Learning Objectives

1. ***2020 New Jersey Student Learning Standards – Science*:**
    - "Scientific and technological advances have proliferated and now permeate most aspects of life in the 21st century. It is increasingly important that all members of our society develop an understanding of scientific and engineering concepts and processes. Learning how to construct scientific explanations and how to design evidence-based solutions provides students with tools to think critically about personal and societal issues and needs. Students can then contribute meaningfully to decision-making processes, such as discussions about climate change, new approaches to health care, and innovative solutions to local and global problems."
2. ***2023 New Jersey Student Learning Standards – Mathematics:***
    "A New Jersey education in Mathematics builds quantitatively and analytically literate citizens prepared to meet the demands of college and career, and to engage productively in an information-driven society; …A high-quality mathematics education fosters a population that…leverages data in decision-making and as a lens for discussing, analyzing, and responding to practical questions, persists to make sense of and model problems arising in everyday life, society, and the workplace, thinks critically and strategically to assess quantitative relationships and to solutions to complex problems, employs precise reasoning and constructs viable arguments to deduce conclusions, recognize false statements and assess peers' reasoning, interprets, evaluates and critiques the mathematics embedded in social, scientific and commercial systems, as well as the claims made in the private and public sectors, communicates precisely when conveying, representing, and justifying both qualitative and quantitative perspectives."
3. ***2023 New Jersey Student Learning Standards English Language Arts:***
    A New Jersey education in English Language Arts builds readers, writers, and communicators prepared to meet the demands of college and career and to engage as productive American citizens with global responsibilities. …Students will develop the necessary skills in reading, writing, speaking, and listening that are the foundations for creative and purposeful expression in language read rich, challenging texts that build their knowledge of the world, grow their confidence and identities as readers, and develop critical thinking skills and vocabulary necessary for long-term success[; e]ngage in regular, meaningful, writing authentic tasks, exploring valued topics, writing for impact and expression, and sharing their work with others (including authentic audiences) leverage complex texts and digital media to develop comprehension, active listening, and discussion skills ground daily writing and discussion in evidence, fostering an ability to read critically, build arguments, cite evidence, and communicate ideas to contribute meaningfully as productive citizens evaluate the reliability, credibility, and perspective of authors and speakers across all forms of media express ideas and knowledge through a variety of modalities and media, and serve as effective communicators who purposefully read, write, and speak across multiple disciplines [and l]earn to persist in reading complex texts, establishing lifelong habits to read voluntarily for pleasure, for further education, for information on public policy, and for advancement in the workplace.
4. ***Standard 8.1 (Computer Science) and 8.2 (Design Thinking)* of the *2020 NJSLS:***
    - "The 'Intent and Spirit of the Computer Science and Design Thinking Standards' is to focus on deep understanding of concepts that enable students to think critically and systematically about leveraging technology to solve local and global issues. Authentic learning experiences that enable students to apply content knowledge, integrate concepts across disciplines, develop computational thinking skills, acquire

and incorporate varied perspectives, and communicate with diverse audiences about the use and effects of computing prepares New Jersey students for college and careers."

5. ***Standard 9.4 (Life Literacies and Key Skills)* of the *2020 NJSLS*:**
   - "This standard outlines key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy that are critical for students to develop to live and work in an interconnected global economy."
     ***Climate Change:** The state of New Jersey has mandated instruction in, "Climate Change across all content areas, leveraging the passion students have shown for this critical issue and providing them opportunities to develop a deep understanding of the science behind the changes and to explore the solutions our world desperately needs."
6. ****Amistad Law: N.J.S.A. 18A 52:16A-88:***
   - The inclusion of lessons and resources/texts dealing with the African slave trade, slavery in America, the vestiges of slavery in this country and the contributions of African-Americans to our society will be implemented in English and Social Studies courses in accordance with state law: "Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students."
7. ****Holocaust Law: N.J.S.A. 18A 35-28:***
   - The inclusion of lessons and resources/texts that enable pupils to identify and analyze applicable theories concerning human nature and behavior; to understand that genocide is a consequence of prejudice and discrimination; and to understand that issues of moral dilemma and conscience have a profound impact on life will be implemented in English and Social Studies courses in accordance with state law: "Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens."
8. ****LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35*:**
   - A transformative approach to the inclusion of lessons and resources/texts on the contributions and issues concerning the LGBTQ+ population and people with disabilities will be implemented across all core subjects in accordance with state law: "A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36). A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35."
9. ****Asian American and Pacific Islanders Legislation: N.J.S.A 4021/A6100:***
   - The inclusion of lessons and resources/texts on the history and contributions of Asian Americans and Pacific Islanders will enable New Jersey's schools to provide a curriculum that reflects the diversity of our state. In accordance with state law: "A board of education shall include instruction on the history and contributions of Asian Americans and Pacific Islanders in an appropriate place in the curriculum of students in grades kindergarten through as part of the school district's implementation of the New Jersey Student Learning Standards in Social Studies."
10. Acquisition/development/refinement of the higher-order critical thinking skills aligned with the *Revised Bloom's Taxonomy of Cognitive Objectives*

Section III: Curriculum Modifications

The *Physics Honors* curriculum is subject to case-by-case modifications to support/advance the needs of all students, including special education students, English language learners, gifted students and those at risk of school failure. These modifications are based on Individualized Learning Programs (IEPs), recommendations made by the district's English Language Learners (ELL) coordinator, feedback from members of the Intervention & Referral Services Team (*I&RS*) for at-risk students, and 504 Plans.

Coursework and assessments will be modified on an individual basis for students when necessary. Modifications may include but are not limited to those outlined on the Modifications/Accommodations for Science Course chart.

Section IV: Preparation for Standardized Testing

Instruction in *Physics Honors* is aligned with the requirements of state and national standardized assessments, including the *NJGPA*, *NJSLA*, the *ACT*, the *PSAT* and the *SAT*.

Section V: Curriculum Pacing Guide

Curriculum Pacing Guide	
Course Title: *Physics Honors*	**Grade Level:** 9th
Unit I: Mechanics	Weeks 1 - 9
Unit II: Energy, Momentum & Circular Motion	Weeks 10 - 18
Unit III: Waves, Sound & Light	Weeks 19 - 29
Unit IV: Electricity & Magnetism	Weeks 30 - 40

Section VII: Primary Texts and Year-Long Instructional Resources

The following texts and instructional resources are employed for all students in *Physics Honors*:

- Google Classroom
- Common Sense Education
- *Turnitin.com (*https://www.turnitin.com/)
- Modifications/Accommodations for Science Course
- PhET Simulations
- oPhysics Interactive Physics Simulator
- The Physics Classroom
- Textbook: Physics (12th Edition), John Cutnell, Kenneth Johnson, David Young and Shane Stadler, Wiley (2018)

Section VIII: Grading Formula and Assessment Modes

Marking period grades in *Physics Honors* are determined via a percentage weighting model. The specific grading categories and weightings of each will be determined before the start of each academic year and will be published in the posted/distributed course syllabi.

Assessments in *Physics Honors* vary greatly in format, scope/content/skills assessed, and alternative assessments, differentiation in assessments and choice will be incorporated as appropriate. Preliminary assessments of each format will be used as benchmarks and summative assessments will be created/revised collaboratively each year and planned by members of the *Physics Honors* instructional team to inform future learning and to measure student growth.

Section IX: Unit Templates

The following unit templates have been established for the *Physics Honors* curriculum by the *Physics Honors* instructional team:

Unit I: Mechanics
Unit Summary
In this unit, students will dive into the study of motion, forces, and the laws governing them. Students will begin by understanding the basic principles of motion, including concepts such as displacement, velocity, and acceleration. Through hands-on activities and real-world examples, students will explore Newton's Laws of Motion, gaining insight into how forces influence the motion of objects. Students will continue to study motion through investigations of different

types of forces, learning to analyze force diagrams. By the end of this unit, students will have a strong foundation of fundamental mechanical problems. enabling them to predict and explain the motion of objects in various scenarios. Students will not only deepen their conceptual understanding of physics but also enhance their mathematical computational skills through the application of Algebra I and Geometry concepts in problem-solving and data analysis. Skills developed through complex vector operations and trigonometry will also be utilized to solidify students' understanding.

Standards/Core Ideas/Performance Expectations/Progress Indicators

The state standards outlined below, and established by the New Jersey Department of Education, will guide instruction throughout this unit in *Physics Honors:*

- *2020 New Jersey Student Learning Standards: Science*
  - HS-PS2-1, HS-PS2-2, HS-PS2-3, HS-PS2-4, HS-PS2-5, PS2.A, ETS1.C, ESS2.B
- *2023 New Jersey Student Learning Standards: Mathematics*
  - MP.2, MP.4, N.Q.A.1, N.Q.A.2, N.Q.A.3, A.SSE.A.1, A.SSE.B.3, A.CED.A.1, A.CED.A.2, A.CED.A.4, F-IF.C.7, S-IS.A.1
- *2023 New Jersey Student Learning Standards English Language Arts*
  - RL.CR.9–10.1, RI.MF.9–10.6, W.AW.9–10.1.A,B & E, SL.PE.9–10.1, SL.II.9–10.2, SL.PI.9–10.4
- *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*
  - 8.1.12.DA.1, 8.1.12.DA.2, 8.1.12.DA.5
- *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies, and Key Skills*
  - 9.4.12.CI.1, 9.4.12.CT.1, 9.4.12.IML.3, 9.4.12.IML.4, 9.4.12.TL.2

Unit Essential Questions	Unit Enduring Understandings
• What are the fundamental quantities used to describe motion and how are they related? • How does an object's displacement differ from its distance traveled? • What factors influence an object's velocity and how is velocity calculated? • What is acceleration and how does it relate to changes in velocity over time? • What are Newton's three laws of motion and how do they govern the behavior of objects? • How do forces affect the motion of objects and how can we represent these forces using diagrams? • What are the different types of forces and how do they interact in various situations? • How can we use Newton's laws and force analysis to predict and explain the motion of objects? • What role does mathematics, specifically Algebraic and Geometric concepts, play in solving mechanical problems and analyzing data in physics? • How do real-world examples and hands-on activities enhance our understanding of mechanics and its applications?	• Understanding motion requires grasping fundamental quantities such as displacement, velocity, and acceleration, which form the basis for describing the dynamics of objects. • Recognizing the distinction between displacement and distance traveled is crucial in accurately describing the motion of objects, including scenarios involving changes in direction. • Velocity is not only determined by speed but also by the direction of motion, drawing on the vector nature and the importance of considering both magnitude and direction. • Acceleration quantifies the rate at which an object's velocity changes over time, providing insight into how quickly an object's motion is changing. • Newton's three laws of motion serve as the foundational principles governing the behavior of objects in motion, proving the framework for understanding and predicting the dynamics of various systems. • Forces exerted on objects directly influence their motion; understanding force interactions allows for the prediction and analysis of object dynamics through force diagrams. • Recognizing the diverse types of forces, such as gravitational, frictional and tension forces, provides insight into the complex interactions influencing the motion of objects in different scenarios. • Applying Newton's laws and force analysis enables the prediction and explanation of objects in motion, empowering students to make accurate predictions and explanations based on fundamental principles. • Utilizing mathematical concepts from Algebra and Geometry facilitates the modeling and analysis of mechanical systems. • Connecting theoretical concepts to real-world examples and hands-on activities enhances understanding and demonstrates the practical relevance of mechanics in everyday situations and engineering applications.

Evidence of Learning

Formative & Alternative Assessments:	Benchmark & Summative Assessments:	Resources Needed:
• Lab #1 Paper Airplane • Motion Graph Analysis • Lab #2 Buggy Car • Lab #3 Moving Man • Freefall picket fence lab • Vector walk/treasure hunt lab • Lab #7 Newton's 2nd Law • Lab #8 Friction Lab • Classwork • Review guides • Performance activities • Quizzes • Individual student check ins with teacher • Student research of past and current physicists*	• Displacement Quiz (Benchmark) • XV Graphs Quiz • Velocity & Acceleration Quiz • Kinematics Equations Quiz • Lab #5 Bottle Rocket (Benchmark) • Lab #6 Projectile Simulation • Projectile Motion Quiz • Newton's Laws Quiz • Forces Quiz • Friction Quiz • Summative #1	• Common Sense Media - Truth in News* • Phet Simulation Software • oPhysics Interactive Physics Simulator • Vernier Graphical Analysis • The Physics Classroom (Concept Checker) • Vernier Lab Hardware • TI-34 Scientific Calculator • TI-84 Graphing Calculator

Unit II: Energy, Momentum & Circular Motion

Unit Summary

This unit will introduce students to the concept of energy and its various forms. Students will explore potential energy, kinetic energy, and the principles of energy conservation. Through simulations and experiments, students will investigate how energy is transferred and transformed within systems. Students will be able to identify the relationships between work, power, force and energy. Building on the concept of energy, students will explore the concept of momentum in the context of collisions, understanding how momentum is conserved in both elastic and inelastic collisions. After the unit, students will be able to connect the fundamental role of energy in the universe and its applications in solving real-world problems. Students will not only deepen their conceptual understanding of physics but also enhance their mathematical computational skills through the application of Algebra I and Geometry concepts in problem-solving and data analysis. Skills developed through complex vector operations and trigonometry will also be utilized to solidify students' understanding.

Standards/Core Ideas/Performance Expectations/Progress Indicators

The state standards outlined below, and established by the New Jersey Department of Education, will guide instruction throughout this unit in *Physics Honors:*

- *2020 New Jersey Student Learning Standards: Science*
  - HS-PS2.1, HS-PS2-2, HS-PS2-3, HS-PS2.4, HS-PS3-1, HS-PS3-2, HS-PS3-3, HS-ESS1-4, HS-ETS1-2, PS2.A, PS2.B, PS3.A, PS3.B, PS3.D, Ess1.B, ETS1.A, ETS1.C
- *2023 New Jersey Student Learning Standards: Mathematics*
  - MP.2, MP.4, N.Q.A.1, N.Q.A.2, N.Q.A.3, A.SSe.A.1, A.SSE.B.3, A.CED.A.1, A.CED.A.2, A.CED.A.4, F-IF.C.7, S-IS.A.1
- *2023 New Jersey Student Learning Standards English Language Arts*
  - RL.CR.9–10.1, RI.MF.9–10.6, W.AW.9–10.1.A,B & E, SL.PE.9–10.1, SL.II.9–10.2, SL.PI.9–10.4
- *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*
  - 8.1.12.DA.1, 8.1.12.DA.2, 8.1.12.DA.5, 8.2.12.ED.1, 8.2.12.ED.2, 8.2.12.ED.5, 8.2.12.ED.6
- *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies, and Key Skills*
  - 9.4.12.CI.1, 9.4.12.CT.1, 9.4.12.IML.3, 9.4.12.IML.4, 9.4.12.TL.2

Unit Essential Questions	Unit Enduring Understandings
• What is energy, and how is it transferred and transformed within systems? • What are the different forms or energy, and how do they relate to each other? • How does the principle of energy conservation apply to various	• Energy exists in various forms and can be transferred and transformed within systems, leading to changes in the systems' properties and behaviors. • The different forms of energy, such as potential and kinetic energy, are interconnected and can be converted from one form to another according to the principle of energy conservation. • The principle of energy conservation states that energy cannot be created or destroyed but can only be transferred from one form to

systems and phenomena? • What is momentum and how is it related to energy? • How is momentum conserved in different types of collisions? • How do forces, work, power, and energy relate to each other within physical systems? • How do physicists use Newton's Laws of Motion to model the motion of an object moving in a circle and what factors determine whether or not an object will move in a stable, circular path? • How does an object exert a gravitational force on another without being in direct contact with the other object? • How can mathematical concepts from *Algebra I* and *Geometry* be applied to analyze and solve problems related to energy and momentum?	another or transferred between objects within a closed system. Climate change, renewable and non-renewable energy sources, along with other factors go into energy conservation.* • Momentum is intrinsically linked to energy, and changes in momentum within a system correspond to changes in its energy state. • Momentum is conserved in both elastic and inelastic collisions, highlighting a fundamental principle governing the interactions between objects in motion. • Forces, work, power, and energy are interrelated concepts that describe the interactions and transformations within physical systems, with each influencing and shaping the behavior of the system in various ways. • For an object to move in a circle, the force acting on that object must be unbalanced toward the center of the circle, where the velocity is tangential to the circular path and the acceleration is directed toward the center of the circular path. • A massive object alters space around it by creating a gravitational field, exerting a force on other massive objects, acting as the centripetal force. • Mathematical concepts from *Algebra I* and *Geometry* provide powerful tools for analyzing and solving problems related to energy and momentum, allowing for predictions of physical phenomena.

Evidence of Learning

Formative & Alternative Assessments:	**Benchmark & Summative Assessments:**	**Resources Needed:**
• Skate Park Investiga… • Cafiero Weightroom… • Copy of Cafiero Im… • Cafiero Collisions … • Copy of Cafiero Eg… • Copy of Thing on a … • Classwork • Review guides • Quizzes • Individual student check ins with teacher • Renewable and Non-renewable energy discussion incorporating climate change*	• W_{NET} Quiz • $W_{NET}=\Delta KE$ Quiz • ME Quiz • WPE Test • Impulse Quiz • Collisions Quiz (with 2D vectors) • Egg drop • Summative #2 • Copy of Thing on a String • Circular Motion Quiz • Circular Motion Test	• Phet Simulation Software • oPhysics Interactive Physics Simulator • Vernier Graphical Analysis • The Physics Classroom (Concept Checker) • Vernier Lab Hardware • TI-34 Scientific Calculator • TI-84 Graphing Calculator

Unit III: Waves, Sound & Light

Unit Summary

This unit will highlight the fascinating world of waves. Students will learn about the properties of waves, including amplitude, frequency, wavelength, and wave speed. Through hands-on experiments, simulations, and demonstrations, students will explore the behavior of mechanical waves, including sound waves, electromagnetic waves, and light waves. Students will investigate wave phenomena such as interference, diffraction, and resonance, gaining an understanding of how waves propagate through different mediums. By the end of the unit, students will have deepened their knowledge of the nature of waves and their significance in our everyday lives. Students will not only deepen their conceptual understanding of physics but also enhance their mathematical computational skills through the application of *Algebra I* and *Geometry* concepts in problem-solving and data analysis. Skills developed through complex vector operations and trigonometry will also be utilized to solidify students' understanding.

Standards/Core Ideas/Performance Expectations/Progress Indicators

The state standards outlined below, and established by the New Jersey Department of Education, will guide instruction throughout this unit in *Physics Honors:*

- *2020 New Jersey Student Learning Standards: Science*
  - HS-PS4-1, HS-PS4-3, HS-PS4-4, HS-PS4-5, PS4.A, PS4.B
- *2023 New Jersey Student Learning Standards: Mathematics*
  - MP.2, MP.4, A.SSE.A.1, A.SSE.B.3, A-CED.A.4
- *2023 New Jersey Student Learning Standards English Language Arts*
  - RL.CR.9–10.1, RI.MF.9–10.6, W.AW.9–10.1.A,B & E, SL.PE.9–10.1, SL.II.9–10.2, SL.PI.9–10.4
- *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*
  - 8.2.12.ITH.1, 8.2.12.EC.1, 8.2.12.EC.2, 8.2.12.EC.3, 8.2.12.ETW.4
- *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies, and Key Skills*
  - 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.TL.1, 9.4.12.TL.2, 9.4.8.TL.3

Unit Essential Questions	Unit Enduring Understandings
• What are the fundamental properties of waves, and how do they influence wave behavior? • How do mechanical waves, such as sound waves, propagate through different mediums, and what factors affect their speed and intensity? • What are electromagnetic waves, and how do they differ from mechanical waves in terms of propagation and behavior? • How do waves interact with each other and with obstacles, leading to phenomena such as interference, diffraction, and resonance? • What is the role of frequency, wavelength, and amplitude in determining the characteristics of waves? • How do waves, including sound and light waves, manifest in our everyday experiences and contribute to our understanding of the world? • How can mathematical concepts such as *Algebra I* and *Geometry* be applied to analyze and predict wave behavior and phenomena?	• Waves possess fundamental properties such as amplitude, frequency, wavelength, and wave speed, which collectively govern their behavior and characteristics. • Mechanical waves, like sound waves, propagate through different mediums, and their speed and intensity are influenced by the properties of the medium through which they travel. • Electromagnetic waves, unlike mechanical waves, do not require a medium for propagation and exhibit distinct properties and behaviors governed by electromagnetic principles. • Waves interact with each other and with obstacles leading to phenomena such as interference, diffraction, and resonance, which are essential for understanding wave behavior and applications. • Frequency, wavelength, and amplitude are critical parameters that determine the characteristics and behavior of waves, impacting phenomena such as interference, wave propagation, and energy transfer. • Waves, including sound and light waves, are evident in everyday experiences, contributing to our understanding of natural phenomena and technological applications. • Mathematical concepts such as *Algebra I* and *Geometry* provide powerful tools for analyzing and predicting wave behavior, enabling interpretation of wave-related phenomena and applications.

Evidence of Learning

Formative & Alternative Assessments:	Benchmark & Summative Assessments:	Resources Needed:
• 14 Pendulum Periods La… • 21 Sound Waves and Be… • Radiation Investigation • Real life EM '23 • Classwork • Review guides • Quizzes • Individual student check-ins with teacher	• SHM quiz • Waves Basics Quiz • SHM and Waves Test • Sound Basics Quiz • Sound Test	• Phet Simulation Software • oPhysics Interactive Physics Simulator • Vernier Graphical Analysis • The Physics Classroom (Concept Checker) • Vernier Lab Hardware • TI-34 Scientific Calculator • TI-84 Graphing Calculator

Unit IV: Electricity & Magnetism

Unit Summary

This unit will introduce students to the principles of electric charges and circuits. Students will learn the fundamental principles of electrical charges, conductors, and insulators. Through hands-on and circuit-building activities, students will explore Ohm's Law and the behavior of resistors in series and parallel circuits. Students will investigate the practical applications of electricity, including the operation of electrical devices and the design of simple circuits. Students will continue to dive into the unit, exploring the relationship between electricity and magnetism, and understanding how electric currents produce magnetic fields and vice versa. After the unit, students will have acquired a comprehensive understanding of electricity and magnetism and their roles in modern technology. Students will not only deepen their conceptual understanding of physics but also enhance their mathematical computational skills through the application of *Algebra I* and *Geometry* concepts in problem-solving and data analysis. Skills developed through complex vector operations and trigonometry will also be utilized to solidify students' understanding.

Standards/Core Ideas/Performance Expectations/Progress Indicators

The state standards outlined below, and established by the New Jersey Department of Education, will guide instruction throughout this unit in *Physics Honors:*

- *2020 New Jersey Student Learning Standards: Science*
  - HS-PS2-4, HS-PS2-5, HS-PS2-6, HS-PS3-1, HS-PS3-2, HS-PS3-3, HS-PS3-5, PS1.A, PS2.A, PS2.B, PS3.A
- *2023 New Jersey Student Learning Standards: Mathematics*
  - MP.2, MP.4, N.Q.A.1, N.Q.A.2, N.Q.A.3, A.SSE.A.1, A.SSE.B.3, A.CED.A.1, A.CED.A.2, A.CED.A.4, F-IF.C.7
- *2023 New Jersey Student Learning Standards English Language Arts*
  - RL.CR.9–10.1, RI.MF.9–10.6, W.AW.9–10.1.A,B & E, SL.PE.9–10.1, SL.II.9–10.2, SL.PI.9–10.4
- *2020 New Jersey Student Learning Standards: Computer Science and Design Thinking*
  - 8.1.12.DA.1, 8.1.12.DA.5, 8.2.12.ITH.1, 8.2.12.ITH.2, 8.2.12.ITH.3, 8.2.12.EC.1, 8.2.12.EC.2
- *2020 New Jersey Student Learning Standards: Career Readiness, Life Literacies, and Key Skills*
  - 9.4.12.CI.1, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.3, 9.4.12.IML.2, 9.4.8.TL.1, 9.4.8.TL.2, 9.4.8.TL.3

Unit Essential Questions	Unit Enduring Understandings
• What are the fundamental properties of electric charges, and how do they interact with each other? • How do conductors and insulators differ and what are their roles in electrical circuits? • What is Ohm's Law and how can it be used to analyze the behavior of resistors in series and in parallel circuits? • How can you design and build simple electrical circuits to perform specific functions? • What are the practical applications of electricity in everyday life and how do electrical devices operate? • How do electric currents generate magnetic fields and what are the principles behind electromagnetism? • In what ways do electricity and magnetism interact and how are these interactions utilized in modern technology? • How can mechanical concepts from Algebra and Geometry be applied to solve problems and analyze data in the context of electricity and magnetism? • How has the understanding of electricity and magnetism evolved	• Electrical charges are the basic property of particles that cause them to experience a force when placed in an electric field. Opposite charges attract while like charges repel each other. • Conductors allow the free flow of electric charge due to the presence of free electrons. Insulators resist the flow of electric charge, making them essential for controlling and directing electrical current in circuits. • Ohm's Law (V=IR) describes the relationship between voltage, current, and resistance. In series circuits, resistors add up to increase total resistance while in parallel circuits the total resistance decreases. • Designing and building electrical circuits involves understanding circuit components and their configurations. Simple circuits can be created to perform tasks such as lighting a light bulb or powering a device. • Electricity is essential in everyday life, powering devices and systems. Understanding the operation of electrical devices helps with troubleshooting and designing efficient electrical solutions. • Electric currents generate magnetic fields, and this relationship is the foundation of electromagnetism. The principle is used in devices such as electromagnets, motors, and generators. • Electricity and magnetism interact through electromagnetic fields, which are harnessed in technologies such as transformers, indicators, and wireless communication systems. • Algebra and Geometry concepts are vital for solving electrical problems and analyzing data. These mathematical skills enable accurate calculations and predictions in circuit design and functionality. • The understanding of electricity and magnetism has evolved through significant discoveries by scientists such as Faraday,

over time and what are some key historical discoveries in this field? ● What safety precautions should be taken when working with electricity and why are they important?	Maxwell, and Tesla, whose discoveries have led to the development of modern electrical technologies and theories. ● Working with electricity requires adherence to safety precautions to prevent accidents, such as electric shocks or fires. Understanding these precautions ensures safe handling and operation of electrical systems.

Evidence of Learning

Formative & Alternative Assessments:	**Benchmark & Summative Assessments:**	**Resources Needed:**
● Lightning Simulation ● 2023 Electrostatics … ● Electric Field Simula… ● 25 Ohms Law Lab.d… ● 26 Series and Paralle… ● 29 Magnetic Field in… ● Classwork ● Review guides ● Quizzes ● Individual student check-ins with teacher	● Charge Basics Quiz ● Coulomb's Law 1D Quiz ● Coulomb's Law 2D Quiz ● Electric Fields Quiz ● Electrostatics Test ● Electric Potential Quiz ● Ohm's Law Quiz ● Series and Parallel Circuits Quiz ● Circuits Test ● Ampere's Law Quiz ● Lenz's Law Quiz ● Magnetism Test	● Phet Simulation Software ● oPhysics Interactive Physics Simulator ● The Physics Classroom (Concept Checker) ● Vernier lab hardware ● TI-34 Scientific Calculator ● TI-84 Graphing Calculator

Section X: Unit Reflection

The *Physics Honors* instructional team must confer upon the completion of each instructional unit in the *Physics Honors* curriculum and rate the degrees to which the instructional units meet performance criteria established by the New Jersey Department of Education using the Unit Reflection Form. Completed unit reflection forms must be submitted to the Department Supervisor for approval upon completion of curriculum implementation with a complementing list of suggested modifications to the *Physics Honors* curriculum.

Unit Reflection Form: *Physics Honors*			
Lesson Activities:	**Strongly**	**Moderately**	**Weakly**
Foster student use of technology as a tool to develop critical thinking, creativity and innovation skills;			
Are challenging and require higher-order thinking and problem-solving skills;			
Allow for student choice;			
Provide scaffolding for acquiring targeted knowledge/skills;			
Integrate modern, global perspectives, especially those regarding diversity, genocide, global issues, and historical ones regarding racial relations;			
Integrate 21st century skills;			
Provide opportunities for interdisciplinary connection and transfer of knowledge and skills;			
Are varied to address different student learning styles and preferences;			

Are differentiated based on student needs;			
Are student-centered with teacher acting as a facilitator and co-learner during the teaching and learning process;			
Provide means for students to demonstrate knowledge and skills and progress in meeting learning goals and objectives;			
Provide opportunities for student reflection and self-assessment;			
Provide data to inform and adjust instruction to better meet the varying needs of learners.			

Appendix
Writing Instruction and the RFH Community

Writing instruction should happen across the RFH Community. Writing across the curriculum is a philosophy that advances the belief that writing is a method of learning. Since all departments are committed to helping students learn, writing must be used as a methodology to advance student learning.

Each academic discipline has its own unique conventions, formats and structures. It is the responsibility of each department to agree upon domain-specific writing praxes, model them for students, and require them to utilize them on a consistent basis. Students must understand that acceptable writing in one domain may not be acceptable writing in another area. The development of domain-specific writing skills supports the overall development of the student writer because all writing is grounded in the writing situation: audience, context, purpose, subject, and writer. Representatives from the academic disciplines must share their domain-specific writing praxes with each other, identify intersections, and determine how to address perceived gaps that limit student learning.

Students must experience writing situations that help them learn how to think creatively and critically and communicate effectively in the academic disciplines. Writing instruction, regardless of the academic discipline, must always reinforce student understanding of the writing situation. When students experience writing situations, they must study examples of domain-specific writing in order to understand how writers communicate in discipline-related contexts. This does not mean information embedded in textbooks. Domain-specific writing is writing that is used to inform and influence readers as it draws them into an established circle of discourse. Students must use these non-fiction texts to develop the close reading skills that will shape their own writing. Focused engagement with domain-specific writing should not be limited to basic reading comprehension and topical understanding. It must also include the analysis of the writing situation that is represented in the text: audience, context, purpose, subject, and writer. The close reading of well-written texts—regardless of the domain—will show students the importance of writing mechanics, diction, and syntax. The development of close reading skills will also help the students grow in terms of their ability to construct and advance independent and original claims that are well-supported by evidence. Domain-specific writing is grounded in positioning of claims and the effective use of evidence.

The final written product is important; nevertheless, the learning that results in this production must not be devalued. The writing process is not limited to the basic steps of planning, drafting, revising, and editing/proofreading. It is a complex sequence of critical and creative thinking and writing that leads to the production of a text that provides evidence of learning and understanding. Students must ultimately develop the ability to self-assess the effectiveness of their writing as a representation of the writing situation. Without the use of models that evidence learning and understanding, students will not develop the ability to self-assess their own work—the true outcome of the writing process.

What types of writing situations should RFH students engage in?

RFH students should engage in writing situations across the curriculum that require them to:

- write to improve mechanical proficiency, diction usage, and syntactical sophistication
- write to narrate, describe, and reflect

- write to summarize and report
- write to classify and define
- write to explain how process leads to an outcome
- write to compare, contrast and evaluate
- write to speculate on cause and effect
- write to propose solutions and solve problems
- write to analyze

These writing situations should be positioned in a coordinated, developmental sequence that extends across the academic disciplines.

Upon Completion of Grade 12, RFH students must be ready to transition to the following writing situations:

- write to analyze
- write to persuade (argument)

The core foci of first-year college writing courses are analysis and argument. These courses orient the students to the demands and expectations of writing for the academic culture of college. At colleges/universities with carefully coordinated writing programs, students must demonstrate proficiency in analysis and argument before they transition to upper level courses that require them to engage in the following writing situation:

- write to investigate (research)