Toms River Schools Physics Curriculum 2020
(Grades 10-12)
Aligned to the New Jersey Student Learning Standards for Science (Next Generation Science Standards)

OCEAN COUNTY PHYSICS CURRICULUM	
Content Area: SCIENCE	
Course Title: Physics: College Prep	**Grade Level:** 10 - 12

Unit 1: Forces and Motion	**Marking Period 1** Pace: 45 days
Unit 2: Energy and Momentum	**Marking Period 2** Pace: 45 days
Unit 3: Circular Motion and Fundamental Forces	**Marking Period 3** Pace: 45 days
Unit 4: Waves and Their Interactions	**Marking Period 4** Pace: 25 days
Unit 5: Electricity and Magnetism	**Marking Period 4** Pace: 20 days

Date Revised:	**August 2019**
Board Approved on:	**August 21, 2019**

OCEAN COUNTY PHYSICS CURRICULUM UNIT 1
Forces and Motion

Content Area: Physics

Unit Title: Forces and Motion

Target Course/Grade Level: 10 - 12

Pace: 45 Days

Unit Summary

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. 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 understanding of the core ideas.

Students use mathematical and computational thinking to examine the processes governing the workings of the solar system and universe. 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.

Students will analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution to demonstrate proficiency in engineering practices.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans

Learning Targets

Content Standards

CONTENT STANDARDS LINK:

DCI #	Disciplinary Core Idea (DCI)
PS2.A	Given a graph of position or velocity as a function of time, recognize in what time intervals the position, velocity and acceleration of an object are positive, negative, or zero and sketch a graph of each quantity as a function of time.
PS2.A	Represent forces in diagrams or mathematically using appropriately labeled vectors with magnitude, direction, and units during the analysis of a situation.
PS2.A	Understand and apply the relationship between the net force exerted on an object, its inertial mass, and its acceleration to a variety of situations.
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-PS2-3	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.
HS-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 tradeoffs that account for a range of constraints, including cost, safety, and reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
Interdisciplinary Practices: ELA	
RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
WHST.9-12.2	Write informative/explanatory texts, including, the narration of historical events, scientific procedures/experiments, or technical processes.
WHST.9-12.5	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.
WHST.9-12.7	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.
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and over-reliance on any one source and following a standard format for citation.
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
Interdisciplinary Practice: Mathematics	
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN-Q.A.3	Define appropriate quantities for the purpose of descriptive modeling.

Unit Essential Questions	**Unit Enduring Understandings**
● Why is it important to use vector quantities and not just scalar quantities to describe the motion of an object? ● How does the result of two vectors change	*Students will understand that…* ● All motion must be compared to a frame of reference. ● Many quantities in physics are rates of change of

as the angle between the two changes? ● How does the shape of graphs representing the relationship between displacement, velocity, or acceleration vs. time offer information about the motion of an object? ● How is the motion of an object affected by the acceleration of gravity? ● Why is the initial acceleration of a sprint runner important in determining who will win the race? ● How does the direction of the acceleration affect the direction of motion? ● How is the distance a baseball travels before hitting the ground affected by the throwing conditions? ● How does the description of motion of an object change depending on the reference frame used to describe it? ● How can you prove that all objects fall at the same rate? ● Why does a projectile make a parabolic path?	other quantities. ● Vectors are specified by magnitude and direction while scalars are magnitude only. ● Velocity is a change of position. ● Acceleration is the rate at which velocity changes. ● In the absence of air resistance, all bodies fall with the same acceleration. ● The slope of a velocity vs. time graph is acceleration. ● Projectile motion has vertical and horizontal components and is motion under the influence of gravity. ● Newton's laws govern the motion of objects.
Unit Objectives *Students will know…* ● Theories and laws provide explanations in science. ● Laws are statements or descriptions of the relationships among observable phenomena. ● Empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. ● Newton's second law accurately predicts changes in the motion of macroscopic objects. ● When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. ● Criteria and constraints also include satisfying any requirements set by society,	**Unit Objectives** *Students will be able to…* ● Analyze data using tools, technologies, and/or models 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. ● Describe the boundaries and initial conditions of a system of two macroscopic bodies moving in one dimension. ● Analyze graphs of position, velocity, and acceleration versus time. ● Analyze the motion of objects in free fall. ● Analyze projectile motion. ● Apply Newton's Laws to analyze the motion of objects

such as taking issues of risk mitigation into account, and the criteria and constraints should be quantified to the extent possible and stated in such a way that one can determine whether a given design meets them. ● Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. ● When evaluating solutions, it is important to take into account a range of constraints— including cost, safety, reliability, and aesthetics—and to consider social, cultural, and environmental impacts. ● New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology.	

OCEAN COUNTY PHYSICS CURRICULUM **Evidence of Learning**
Formative Assessments Observation Homework Class participation Writing assessments Do-Now Lab reports Notebooks Quizzes

Summative Assessments

Chapter/Unit Tests

Presentations/Projects

Laboratory Practicals

Quarterly exams

Midterms/Finals

Benchmark

New Jersey Student Learning Assessment:Science (NJSLA)

Quarterly Exams

Unit Test

Performance Assessment

Alternative

Oral Presentation

Video Recording

Virtual Lab

Modifications (ELLs, Special Education, Gifted and Talented)

ELL:

- Audiobooks, Movies, and other digital media in lieu of print versions
- Native language tests and native language English Dictionary

Special Education

- Response to Intervention (RTI)
- Follow all IEP modifications
- Oral Instructions
- Record lessons instead of taking notes
- Outline of lessons
- Study guide with answers
- Word Processor to type notes
- Frequent breaks

Students at Risk of School Failure:

- ❑ Extended Time
- ❑ Flexible Grouping
- ❑ Small Group Instruction
- ❑ Peer Buddies
- ❑ Tiered Activities
- ❑ Manipulatives
- ❑ Graphic Organizers

504:

- ❑ Utilize graphic organizers to help provide a purpose for reading and increase comprehension
- ❑ Assign peer tutor
- ❑ Provide clear and specific directions
- ❑ Provide class notes ahead of time to allow students to preview material and increase comprehension

- ❏ Provide extended time
- ❏ Simplify written and verbal instructions

Gifted and Talented:

- Peer Tutoring
- Cooperative learning groups
- Differentiated instruction

Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:

Laboratory manuals and equipment
Textbooks/Resource Binders
Internet
Videos

Teacher Notes:

Lecture/class discussion
Labs
Study guides
Create posters/PowerPoint presentations

OCEAN COUNTY PHYSICS CURRICULUM UNIT 2
Energy and Momentum

Content Area: Physics

Unit Title: Energy and Momentum

Target Course/Grade Level: 10 – 12

Pace: 45 days

Unit Summary

Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's *total* energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. Momentum is the product of mass and velocity; the total momentum of a system of objects is conserved when there is no net force on the system. Students are also able to apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

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 understanding of the core ideas.

Students use mathematical and computational thinking to examine the processes governing the workings of the solar system and universe. 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.

Students will use mathematical representations of phenomena to describe explanations to demonstrate proficiency in engineering practices.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans

Learning Targets

Content Standards

CONTENT STANDARDS LINK:

DCI #	Disciplinary Core Idea (DCI)
PS3.A and PS3.B	Identify and quantify the various types of energies within a system of objects in a well-defined state, such as elastic potential energy, gravitational potential energy, kinetic energy, and thermal energy and represent how these energies may change over time.
PS3.A	Calculate changes in kinetic energy and gravitational potential energy of a system using representations of that system.
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-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-PS3-1	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-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
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 tradeoffs 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.
HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
Interdisciplinary Practices (ELA)	
RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
WHST.9-12.2	Write informative/explanatory texts, including, the narration of historical events, scientific procedures/experiments, or technical processes.
WHST.9-12.5	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.
WHST.9-12.7	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.
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and over-reliance on any one source and following a standard format for citation.
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research.

Interdisciplinary Practices (Mathematics)	
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN-Q.A.3	Define appropriate quantities for the purpose of descriptive modeling.

Unit Essential Questions

- How can one explain and predict interactions between objects and within systems of objects?
- Why and how is energy conserved?
- Why does society spend a lot of resources on controlling thermal energy?
- What happens to the energy in two different objects when the two objects collide?
- Why may a substance feel cold to the touch to one person but warm to another?
- What is the impulse-momentum theorem?
- How do the mass and velocity of two objects affect the results of their collision?
- What is the difference between inelastic collisions and elastic collisions?

Unit Enduring Understandings

Students will understand that…

- Energy can be classified as kinetic and potential.
- We use energy from a diversity of sources in various forms.
- An isolated/closed system is a collection of objects isolated from outside forces and to/from which no net energy flows.
- The total momentum in a closed system is conserved.
- Simultaneous measurement of the momentum and position of a subatomic particle is not possible.
- Momentum is a measure of motion that depends on the mass of the object and its velocity.
- A change in momentum requires a force acting over a period of time.
- Impulse is a change in momentum.
- In elastic collisions, objects bounce off each other after the collision. In inelastic collisions, objects stick together after the collision.
- The kinetic energy before an inelastic collision is not equal to the kinetic energy after an inelastic collision

Unit Objectives *Students will know…*	**Unit Objectives** *Students will be able to…*
● Laboratory Safety Procedures ● Work is the transfer of energy. ● Energy may change from one form to another. ● Energy can be stored by virtue of the position of a mass or charge in a field. ● An isolated/closed system is a collection of objects isolated from outside forces and from which no net energy flows. ● Total energy in a closed system is conserved. ● The momentum of a mass is changed proportionately when an impulse is applied to it. ● The total momentum in a closed system is conserved.t. ● If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system.	● Apply the work-energy theorem. ● Identify various forms of energy. ● Calculate potential energy, kinetic energy, and mechanical energy of a system. ● Calculate the momentum of a moving mass. ● Apply the impulse-momentum theorem. ● Calculate the total momentum of a system. ● Classify collisions as elastic or inelastic. ● Predict the momentum of a mass after a collision or explosion. ● Use laboratory apparatus and instruments to measure mass, force, time and velocity. ● 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. ● Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. ● Apply scientific ideas to solve a design problem for a device that minimizes the force on a macroscopic object during a collision, taking into account possible unanticipated effects.

OCEAN COUNTY PHYSICS CURRICULUM
Evidence of Learning

Formative Assessments

Observation
Homework
Class participation
Writing assessments
Do-Now
Lab reports
Notebooks
Quizzes

Summative Assessments

Chapter/Unit Tests
Presentations/Projects
Laboratory Practicals
Quarterly exams
Midterms/Finals

Benchmark

New Jersey Student Learning Assessment:Science (NJSLA)
Quarterly Exams
Unit Test
Performance Assessment

Alternative

Oral Presentation
Video Recording
Virtual Lab

Modifications (ELLs, Special Education, Gifted and Talented)

ELL:

- Audiobooks, Movies, and other digital media in lieu of print versions
- Native language tests and native language English Dictionary

Special Education

- Response to Intervention (RTI)
- Follow all IEP modifications
- Oral Instructions
- Record lessons instead of taking notes
- Outline of lessons
- Study guide with answers
- Word Processor to type notes
- Frequent breaks

Students at Risk of School Failure:

- ❑ Extended Time
- ❑ Flexible Grouping
- ❑ Small Group Instruction
- ❑ Peer Buddies
- ❑ Tiered Activities
- ❑ Manipulatives
- ❑ Graphic Organizers

504:

- ❑ Utilize graphic organizers to help provide a purpose for reading and increase comprehension
- ❑ Assign peer tutor
- ❑ Provide clear and specific directions
- ❑ Provide class notes ahead of time to allow students to preview material and increase comprehension
- ❑ Provide extended time
- ❑ Simplify written and verbal instructions

Gifted and Talented:

- Peer Tutoring
- Cooperative learning groups
- Differentiated instruction

Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:

Laboratory manuals and equipment
Textbooks/Resource Binders
Internet
Videos

Teacher Notes:
Lecture/class discussion
Labs
Study guides
Create posters/PowerPoint presentations

OCEAN COUNTY PHYSICS CURRICULUM UNIT 3
Circular Motion and Fundamental Forces

Content Area: Physics

Unit Title: Circular Motion and Fundamental Forces

Target Course/Grade Level: 10 – 12

Pacing: 45 days

Toms River Schools Physics Curriculum 2020
(Grades 10-12)
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Unit Summary

In this unit of study, students plan and conduct investigations and apply scientific ideas to make sense of uniform circular motion, Newton's law of gravitation and Coulomb's Law. Newton's Law of Gravitation and Coulomb's Law are applied to describe and predict the gravitational and electrostatic forces between objects.

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 understanding of the core ideas.

Students use mathematical and computational thinking to examine the processes governing the workings of the solar system and universe. 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.

Students will use mathematical representations of phenomena to describe explanations to demonstrate proficiency in engineering practices.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans

Learning Targets

Content Standards

CONTENT STANDARDS LINK:

DCI #	Disciplinary Core Idea (DCI)
PS2.A	Newton's second law accurately predicts changes in the motion of macroscopic objects.
PS2.B	Make predictions about the sign and relative quantity of net charge of objects or systems after various charging processes.
PS2.B	Construct an explanation of a model of electric charge, and make a qualitative prediction about the distribution of positive and negative electric charges within neutral systems as they undergo various processes.
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.

Interdisciplinary Practices (ELA)

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.

RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
WHST.9-12.2	Write informative/explanatory texts, including, the narration of historical events, scientific procedures/experiments, or technical processes.
WHST.9-12.5	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.
WHST.9-12.7	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.
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and over-reliance on any one source and following a standard format for citation.
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
Interdisciplinary Practices (Mathematics)	
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN-Q.A.3	Define appropriate quantities for the purpose of descriptive modeling.

Unit Essential Questions	**Unit Enduring Understandings**
● What is circular motion? ● What is gravity and how does it affect objects in space? ● What are centripetal force and centripetal acceleration? ● How does the separation of two bodies affect the gravitational force between those bodies?	*Students will understand that…* ● Newton's Law of Universal Gravitation provides the mathematical models to describe and predict the effects of gravitational forces between distant objects. . ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of the gravitational force between objects. ● Kepler's Laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. ● Coulomb's Law provides the mathematical models to describe and predict the effects of electrostatic forces between distant objects.

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Unit Objectives *Students will know…*	**Unit Objectives** *Students will be able to…*
● The gravitational force between two bodies is inversely proportional to the square of the distance between the two bodies. ● The electric force between two charges is inversely proportional to the square of the distance between the two charges. ● The force of gravity is an attractive force ● The direction of the electric force depends on the sign of the charges involved	● Identify the type of force supplying the centripetal force that acts on any object in uniform circular motion ● Determine the direction of the velocity, acceleration and net force vectors for objects in uniform circular motion ● Use mathematical or computational representations to predict the motion of orbiting objects in the solar system. ● Use algebraic thinking to examine scientific data and predict the motion of orbiting objects in the solar system. ● Apply the proportional relationship of the Law of Universal Gravitation ● Apply the proportional relationship of Coulomb's Law ● Explain why a spaceship in a stable circular orbit is in free fall and why a person in that spaceship experiences weightlessness ● Use Newton's Second Law and the Law of Universal Gravitation to show why all objects near the surface of the earth fall with the same constant acceleration ● Demonstrate how Newton's Law of Universal Gravitation provides explanations for observed scientific phenomena. ● Observe patterns at different scales to provide evidence for gravitational forces between two objects in a system with two objects. ● Use mathematical representations of phenomena to describe or explain how electrostatic force is proportional to charge and inversely proportional to distance squared. ● Use mathematical representations of Coulomb's Law to predict the electrostatic forces between two objects in systems with two objects.

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OCEAN COUNTY PHYSICS CURRICULUM **Evidence of Learning**	
Formative Assessments	
- Observations - Homework - Class participation - Venn Diagrams/Graphic Organizers - Do-Now - Laboratories/Lab Reports - Notebooks - Writing Assignments	
Summative Assessments	
· Chapter/Unit Test · Writing Assignments · Presentations · Laboratory Practical - Mid-Term and Final Exams	
Benchmark	
- New Jersey Student Learning Assessment:Science (NJSLA) - Quarterly Exams - Unit Test - Performance Assessment	
Alternative	
- Oral Presentation - Video Recording - Virtual Lab	
Modifications (ELLs, Special Education, Gifted and Talented) **ELL:** - Audiobooks, Movies, and other digital media in lieu of print versions - Native language tests and native language English Dictionary **Special Education** - Response to Intervention (RTI) - Follow all IEP modifications - Oral Instructions - Record lessons instead of taking notes	

- Outline of lessons
- Study guide with answers
- Word Processor to type notes
- Frequent breaks

Students at Risk of School Failure:

- ❑ Extended Time
- ❑ Flexible Grouping
- ❑ Small Group Instruction
- ❑ Peer Buddies
- ❑ Tiered Activities
- ❑ Manipulatives
- ❑ Graphic Organizers

504:

- ❑ Utilize graphic organizers to help provide a purpose for reading and increase comprehension
- ❑ Assign peer tutor
- ❑ Provide clear and specific directions
- ❑ Provide class notes ahead of time to allow students to preview material and increase comprehension
- ❑ Provide extended time
- ❑ Simplify written and verbal instructions

Gifted and Talented:

- Peer Tutoring
- Cooperative learning groups
- Differentiated instruction

Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:

Laboratory manuals and equipment
Textbooks/Resource Binders
Internet
Videos

Teacher Notes:

Lecture/class discussion
Labs
Study guides
Create posters/PowerPoint presentations

OCEAN COUNTY PHYSICS CURRICULUM UNIT 4
Waves and Their Interactions

Content Area: Physics

Unit Title: Waves and their Interactions

Target Course/Grade Level: 10 - 12

Pacing: 25 days

Toms River Schools Physics Curriculum 2020
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Unit Summary

Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter. By understanding wave properties and the interactions of electromagnetic radiation with matter, scientists and engineers can design systems for transferring information across long distance, storing information and investigating nature on many scales – some of them far beyond direct human perception.

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 understanding of the core ideas.

Students use mathematical and computational thinking to examine the processes governing the workings of the solar system and universe. 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.

Students will plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly to demonstrate proficiency in engineering practices.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans

Learning Targets

Content Standards
CONTENT STANDARDS LINK:

DCI #	Disciplinary Core Idea (DCI)
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-PS4-3	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 of 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-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-ETS1-3	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-PS4-2	Evaluate questions about the advantages of using a digital transmission and storage of information.
Interdisciplinary Practices (ELA)	
RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
WHST.9-12.2	Write informative/explanatory texts, including, the narration of historical events, scientific procedures/experiments, or technical processes.
WHST.9-12.5	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.
WHST.9-12.7	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.
WHST.11-12.8	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and over-reliance on any one source and following a standard format for citation.
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
Interdisciplinary Practices (Mathematics)	
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
HSN-Q.A.3	Define appropriate quantities for the purpose of descriptive modeling.

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Unit Essential Questions	**Unit Enduring Understandings**
● How are waves used to transfer energy, information and to extend human senses? ● What are the characteristics of a wave? ● What happens when two waves collide? ● What happens when a wave encounters a boundary? ● What is refraction? ● What is the Doppler Effect?	*Students will understand that…* ● Waves transfer energy without transferring matter. ● Waves pass through each other producing constructive and destructive patterns. ● The velocity of a wave is a function of the wavelength and frequency. ● Electromagnetic waves are integrated into their everyday lives. ● Reflection and refraction of light waves determine how images are formed.
Unit Objectives *Students will know…* ● Vocabulary and key terms ● Explain that waves transfer energy without transferring matter. ● The electromagnetic spectrum ● The energy of an electromagnetic wave is related to its frequency. ● Distinguish between longitudinal and transverse waves. ● Define wavelength, frequency, amplitude and period. ● Explain that wave speed depends on the medium. ● Describe how waves are reflected and refracted between media. ● Explain how waves diffract. ● Apply the Principle of Superposition to the phenomenon of interference. ● Relate the physical properties of sound waves to the wave we perceive sound. ● Describe the Doppler Effect ● Demonstrate an understanding of resonance. ● That light is the visible portion of the electromagnetic spectrum. ● Describe the ray model of light. ● Explain the Law of Reflection.	**Unit Objectives** *Students will be able to…* ● Provide examples of longitudinal and transverse waves. ● Label the parts of a wave on a diagram. ● Perform calculations using the wave equation. ● Apply the Law of Reflection. ● Apply Snell's Law. ● Predict constructive or destructive interference. ● Explain why there is a variation among instruments and among voices (timbre, resonance, fundamental, harmonic) ● Apply the magnification and mirror equation.

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OCEAN COUNTY PHYSICS CURRICULUM **Evidence of Learning**	
Formative Assessments	
- Observations - Homework - Class participation - Venn Diagrams/Graphic Organizers - Do-Now - Laboratories/Lab Reports - Notebooks - Writing Assignments	
Summative Assessments	
· Chapter/Unit Test · Writing Assignments · Presentations · Laboratory Practical - Mid-Term and Final Exams	
Benchmark	
- New Jersey Student Learning Assessment:Science (NJSLA) - Quarterly Exams - Unit Test - Performance Assessment	
Alternative	
- Oral Presentation - Video Recording - Virtual Lab	
Modifications (ELLs, Special Education, Gifted and Talented) **ELL:** - Audiobooks, Movies, and other digital media in lieu of print versions - Native language tests and native language English Dictionary **Special Education** - Response to Intervention (RTI) - Follow all IEP modifications - Oral Instructions - Record lessons instead of taking notes	

- Outline of lessons
- Study guide with answers
- Word Processor to type notes

Students at Risk of School Failure:

- ❑ Extended Time
- ❑ Flexible Grouping
- ❑ Small Group Instruction
- ❑ Peer Buddies
- ❑ Tiered Activities
- ❑ Manipulatives
- ❑ Graphic Organizers

504:

- ❑ Utilize graphic organizers to help provide a purpose for reading and increase comprehension
- ❑ Assign peer tutor
- ❑ Provide clear and specific directions
- ❑ Provide class notes ahead of time to allow students to preview material and increase comprehension
- ❑ Provide extended time
- ❑ Simplify written and verbal instructions
- Frequent breaks

Gifted and Talented:

- Peer Tutoring
- Cooperative learning groups
- Differentiated instruction

Curriculum Development Resources/Instructional Materials/Equipment Needed Teacher Resources:
Laboratory manuals and equipment
Textbooks/Resource Binders
Internet
Videos

Teacher Notes:
Lecture/class discussion
Labs
Study guides
Create posters/PowerPoint presentations

OCEAN COUNTY PHYSICS CURRICULUM UNIT 5
Electricity and Magnetism

Content Area: Physics

Unit Title: Electricity and Magnetism

Target Course/Grade Level: 10-12

Pacing: 20 days

Unit Summary

Forces at a distance are explained by fields permeating space that can transfer energy through space. Magnets or changing electric fields cause magnetic fields; electric charges or changing magnetic fields cause electric fields.

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 understanding of the core ideas.

Students use mathematical and computational thinking to examine the processes governing the workings of the solar system and universe. 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.

Students will analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution to demonstrate proficiency in engineering practices.

Primary interdisciplinary connections:

Infused within the unit are connections to the 2016 NJ Learning Standards for Mathematics, Language Arts Literacy and Technology.

Career Readiness, Life Literacies, and Key Skills

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans

Learning Targets

Content Standards

CONTENT STANDARDS LINK:

DCI #	Disciplinary Core Idea
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-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.

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Unit Essential Questions	**Unit Enduring Understandings**
● How do charges interact with electric and magnetic fields?	*Students will understand that…* ● Charges attract proportionally to their magnitude but inversely proportional to the squared distance between them. ● Current is a flow of charges. ● Components of circuits can be arranged in series and/or parallel.

	● Current through a circuit is dependent on the applied voltage and net resistance.
Unit Objectives *Students will know…* ● Vocabulary and key terms ● Like charges repel and opposite charges attract. ● Ground is the reference point for voltage measurements. ● Voltage is an electric potential difference between two points. ● Coulomb's Law describes the force between charges. ● Charge is conserved. ● Current is the movement of charges. ● Ohm's Law. ● Electrical schematic drawings are essential in designing and building circuits. ● Difference in behavior of components in series versus parallel circuits. ● How to calculate equivalent resistance. ● The relationship between power, current and voltage.	**Unit Objectives** *Students will be able to…* ● Calculate the force between charges. ● Measure the voltage at any point in a circuit using a voltmeter. ● Draw electric field lines. ● Describe processes of charge transfer. ● Perform calculations involving current, resistance, and voltage. ● Draw simple schematic diagrams. ● Compare and contrast series and parallel circuits. · Calculate net resistance in a circuit. ● Calculate electrical power.

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Labs
Study guides
Create posters/PowerPoint presentations