



MIDLAND PARK PUBLIC SCHOOLS
Midland Park, New Jersey
CURRICULUM

Physics

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Approved by the Midland Park Board of Education on
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Physics

Course Description:

Physics is the study of matter and its motion through the universe and time. The laws of physics affect everything in the universe from matter, energy, forces or waves. The units are designed as follow:

Kinematics (32 days)

- Motion in one dimension
- Newton's Law

Dynamics (22 days)

- Vectors & Projectiles
- Forces in Two Dimensions

Momentum & Its Conservation (10 days)

- Momentum
- Collisions

Circular Motion & Satellite Motion (8-9 days)

- Circular Motion
- Law of Gravitation
- Kepler's Laws

Work, Energy, & Power (21-25 days)

- Kinetic & Potential Energy
- Work Energy Theorem
- Power
- Alternative Energy Sources
- Nuclear Energy
- Fission & Fusion

Static Electricity (14 days)

- Electrostatics
- Electric field lines

Current Electricity (13-15 days)

- Flow of charge
- Electric Circuits
- Rate of charge flow
- Series, Parallel & Combination Circuits

Magnets (5-8 days)

- Magnetic fields & forces
- Electromagnetism

Waves (40-45 days)

- Properties & behavior of waves
- Sound Waves
- Light Waves
- Reflection & Refraction
- Mirror and Optical phenomena

Aspects of physical science; chemistry; earth & space science; engineering, technology and applications of science are taught throughout the year. A guided inquiry program, problem-based learning and engineering projects will give students the opportunity to explore topics and concepts through investigations. Participating in this hands-on program helps students:

1. To be prepared for College/Career by emphasizing key skills and practices (NGSS, CCSS, STEM).
2. Become lifelong learners and engaged citizens.

Pre-requisite: Algebra 1

Suggested Course Sequence*:

Unit 1

Motion - Kinematics, Dynamics, Momentum, Circular Motion, Gravitation

Unit 2

Energy - Kinetic & Potential Energy, Alternative Energy, Nuclear Energy

Unit 3

Charges - Electrostatics, Electricity, Circuits, magnets, magnetic fields and forces

Unit 4

Waves - Characteristics of Waves, Sound, Light, Reflection & Refraction, Mirror & Optical Phenomena

*The number of instructional days is an estimate based on the information available at this time. 1 day equals approximately 48 minutes of seat time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.

Unit Overview	
Content Area: Science	
Unit Title: Energy	
Grade Level: 9-12	
Unit Summary: Energy can change from one form to another without a net loss or gain.	
<p>Interdisciplinary Connections: HS.PS3.A, HS-PS3.C, HS-PS3.D, HS.ETS1.A, HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3) RST.11-12.1, SL.11-12.5, WHST.9-12.7, WHST.11-12.8, WHST.11-12.9 MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3</p>	
<p>21st Century Themes and Skills: CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11</p>	
<p>Technology: 8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4, 8.1.12.A.4</p>	
<p>NGSS: Cross Cutting Concepts Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.</p> <p>-Cause and Effect: Mechanisms and Predictions</p> <p>-Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.</p> <p>-Systems and System Models - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.</p> <p>-Structure and Function - The way an object is shaped or structured determines many of its properties</p>	
Learning Targets	
Standards (Content and Technology):	
CPI#:	Statement:
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-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-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> ● How does energy change from one form to another? ● What is work and power? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> ● Change of energy from one form to another. ● Calculating work and power.

<ul style="list-style-type: none"> ● What is mechanical energy? ● How are work & kinetic energy of a moving object related? ● 	<ul style="list-style-type: none"> ● Law of Conservation of Energy
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Unit Learning Targets/Objectives:

Students will

- Determine when work is done on an object
- Create a computational model to calculate work and power in a system.
- Forms of mechanical energy
- Relate energy associated with the relative position of an object
- List three examples of potential energy
- Relate work and kinetic energy.
- Apply the law of conservation of energy
- Design, build and refine a device that changes one form of energy to another
- Analyze the role of energy in sustaining life.
- Analyze different types of energy on earth.
- Explore risks and benefits to new & emerging energy sources
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Evidence of Learning

Formative Assessments: Test, Completed project with rubric

Summative/Benchmark Assessment(s): Quizzes, homework, Q&A, Lab, worksheets, exit slips

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com/mmedia/energy/ce.cfm>

interactive: <http://www.physicsclassroom.com/Physics-Interactives/Work-and-Energy>

<http://vip.vast.org/Amuse.htm>

roller coaster design: <http://vip.vast.org/BOOK/DESIGNIN/HOME.HTM>

roller coaster calculations: <http://vip.vast.org/BOOK/TEST1/HOME.HTM>

http://vip.vast.org/BOOK/online_lab/measure.htm

<http://www.real-world-physics-problems.com/roller-coaster-physics.html>

<http://www.physicsclassroom.com/mmedia/circmot/rcd.cfm>

Modifications: group problem solving, peer tutoring,

modeling,

● Special Education Students:

● Hands on lab activity

● At-Risk Students:

● Hands on activity

● cooperative learning

- **Cooperative learning**
 - **Peer tutoring**
 - **Extended time**
 - **English Language Learners:**
 - **Hands-on activities & explanations**
 - **Assess comprehension through demonstration**
 - **Give instructions/directions in writing & orally**
 - **Use translation dictionaries to locate words in the native language**
- reteach in various methods
 - Gifted and Talented Students:
 - Provide extension activities per student interest

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
Work	What is work?	1 day
Energy	What is energy?	1 day
	How are work and Energy related?	1 day
Power	How power relates to work.	2 days
Mechanical Energy	Different types of mechanical energy.	4 days
Conservation of Energy	Law of Conservation of Energy	2 days
Sources of Energy	Types of Energy Alternative Energy Sources	2-3 days
Project on energy	Determining KE & PE by building with KNEX or pipe covering	6-8 days
Lab	Alternative Energy Project	2-3 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview

Content Area: Science

Unit Title: Mechanics

Grade Level: 11/12

Unit Summary: This unit covers motion, forces in one dimension, displacement, and two dimensional motion and forces.

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.A, HS.PS2.B (HS-PS3-2),(HS-PS3-5), HS.PS3.A, HS.ETS1.C, HS.LS2.B (HS-PS3-1); HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST,11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.9, WHST.11-12.8, MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3, HSA-CED.A.1, HSA-CED.A.2, HSA-CED.A.4, HSA-SSE.A.1, HSA-SSE.B.3, HSF-IF.C.7, HSS-ID.A.1, ETS1.B, ETS1-3, ETS1-4, ETS1.C

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross Cutting Concepts

- Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.
- Cause and Effect: Mechanisms and Predictions
- Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.
- Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
- Structure and Function - The way an object is shaped or structured determines many of its properties and functions.
- Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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-PS2-2	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-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-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> - How do scientists communicate their measurements and observations? - What is the relationship between force and acceleration? - What are Newton’s Three Laws? - What is terminal velocity? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · Scientific Measurement · Acceleration <ul style="list-style-type: none"> - Newton’s Laws - Terminal Velocity
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Unit Learning Targets/Objectives:

Students will...

- Learn How scientists communicate their measurements and observations?
- Define a force
- Relate force and acceleration
- Compare weight and mass
- Analyze the effect air has on falling objects
- Learn Newton’s Three Laws
- Compare and contrast Forces in two dimensions
- Mathematically relate components of vectors
- Discuss friction forces
- Differences between static and kinetic friction
- Analyze equilibrium forces.

Evidence of Learning

Formative Assessments: Tests, Projects with rubrics

Summative/Benchmark Assessment(s): Quizzes, Worksheets, Q & A, Labs, Homework

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulations/category/physics.motio>

Modifications: group problem solving, peer tutoring, modeling,

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|---|--|
| <ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity ● Cooperative learning ● Peer tutoring ● Extended time | <ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity ● cooperative learning |
|---|--|

- **English Language Learners:**
 - **Hands-on activities & explanations**
 - **Assess comprehension through demonstration**
 - **Give instructions/directions in writing & orally**
 - **Use translation dictionaries to locate words in the native language**
- reteach in various methods
 - Gifted and Talented Students:
 - Provide extension activities per student interest

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
Physics Tools	Methods of Science Mathematics & Physics	3 days
	Measurement & Graphing Data	4 days
Representing Motion	Motion Diagrams & Coordinate Systems, Displacement, Position-Time Graphs	4 days
Lab	Diagram Motion & Displacement- Vector Models	1 day
	Velocity & Speed	4 days
Lab	Measuring Velocity	1 day
	Accelerated Motion	3 days
	Free Fall	2 days
Lab	Virtual: Investigating Accelerated Motion	1 day

	Measuring Acceleration	1 day
Forces in one Dimension	Force & Motion - Newton's Second Law Weight & Drag Newton's Third Law	5 days
Project	Newton Car	Built at home 2 day race
Lab	Forces in one dimension	1 day
Motion in two dimensions	Vectors, Friction & Forces in Two Dimensions	4 days
Lab	Friction or Forces	1 day
Project	Design & Build "Egg Car"	5 days
	Projectile Motion	5 days
	Lab Projectile Motion	1 day
	Circular Motion	5 days
	Lab Circular Motion	1 day

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

<http://theuniverseandmore.com>

<https://phet.colorado.edu/en/simulations/category/physics.motion>

Content Area: Science

Unit Title: Gravitation

Grade Level: 11/12

Unit Summary: This unit covers planetary motion, gravitation and the Law of Universal Gravitation.

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.A, HS.PS2.B (HS-PS3-2),(HS-PS3-5), HS.PS3.A, HS.LS2.B (HS-PS3-1); HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST.11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.9, WHST.11-12.8, ETS1.B, ETS1-3, ETS1-4, ETS1.C MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3, HSA-CED.A.1, HSA-CED.A.2, HSA-CED.A.4, HSA-SSE.A.1, HSA-SSE.B.3, HSF-IF.C.7, HSS-ID.A.1

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross-Cutting Concepts

-Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.

-Cause and Effect: Mechanisms and Predictions

-Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

-Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

-Structure and Function - The way an object is shaped or structured determines many of its properties and functions.

-Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:	
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.	
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-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.	
<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> · What is Newton’s law of universal gravitation, and how does it relate to Kepler’s Laws? · How can you describe orbital motion? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · Gravitational force between two objects is proportional to the product of their masses divided by the distance squared between them. 	
<p>Unit Learning Targets/Objectives:</p> <p><i>Students will...</i></p> <ul style="list-style-type: none"> · Learn the relationship between a planet’s orbital radius and Period · Discuss Newton’s Law of universal gravitation · Relate Kepler’s laws to Newton’s law of gravitation · Describe orbital motion · Analyze gravitational mass vs. inertial mass · Explain gravitational force · 		

Evidence of Learning

Formative Assessments: Test

Summative/Benchmark Assessment(s): Worksheets, Lab, Q & A, Internet activity, Homework

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulations/category/physics.motion>

Modifications: group problem solving, peer tutoring, modeling,

- | | |
|--|--|
| <ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity ● Cooperative learning ● Peer tutoring ● Extended time ● English Language Learners: ● Hands-on activities & explanations ● Assess comprehension through demonstration ● Give instructions/directions in writing & orally ● Use translation dictionaries to locate words in the native language | <ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity ● cooperative learning ● reteach in various methods ● Gifted and Talented Students: ● Provide extension activities per student interest |
|--|--|

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
	Kepler's Laws	1 day
	Internet Kepler's Laws	1-2 days
	Newton's Law of Universal Gravitation	2 days
	Orbit of Planets & Satellites	2 days

	Gravitational Fields & types of mass	1 day
Lab	Modeling Orbits	1 day

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview

Content Area: Science

Unit Title: Momentum & Its Conservation

Grade Level: 11/12

Unit Summary:

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST,11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.7, WHST.11-12.8, WHST.11-12.5, ETS1.B, ETS1-3, ETS1-4, ETS1.C MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross-Cutting Concepts

- Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.
- Cause and Effect: Mechanisms and Predictions
- Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.
- Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
- Structure and Function - The way an object is shaped or structured determines many of its properties and functions.
- Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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-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-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> · What is momentum? · What is the law of conservation of momentum? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · How momentum depends on mass and velocity · Relate momentum to car collisions
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<p>Unit Learning Targets/Objectives:</p> <p><i>Students will...</i></p> <ul style="list-style-type: none"> · Learn what an impulse. · Define momentum · Discuss Angular Momentum · Relate Newton's Third Law to conservation of momentum · Explain how the law of conservation of momentum relates to the motion of objects · ·
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Evidence of Learning

<p>Formative Assessments: Test</p> <p>Summative/Benchmark Assessment(s): Worksheets, Q&A, exit slips, Internet activities, Labs, Homework</p> <p>Resources/Materials (copy hyperlinks for digital resources):</p> <p>Conceptual Physics by Hewitt</p> <p>Physics Principles & Problems by Zitzewitz, Haase, Harper</p> <p>http://www.physicsclassroom.com</p> <p>https://phet.colorado.edu/en/simulations/category/physics.momentum</p>
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<p>Modifications: group problem solving, peer tutoring, modeling,</p>	
<ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity 	<ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity

- **Cooperative learning**
 - **Peer tutoring**
 - **Extended time**
 - **English Language Learners:**
 - **Hands-on activities & explanations**
 - **Assess comprehension through demonstration**
 - **Give instructions/directions in writing & orally**
 - **Use translation dictionaries to locate words in the native language**
- cooperative learning
 - reteach in various methods
 - Gifted and Talented Students:
 - Provide extension activities per student interest

Lesson Plans

Lesson Name /Topic	Lesson Objective(s)	Time frame (day(s) to complete)
Momentum	Momentum Impulse-Momentum Theorem	2 days
	Angular Momentum	1 day
	Collisions & Momentum Momentum in a Closed System Two Dimensional Collisions	4 days
	Conservation of Angular Momentum	2 days
Lab	Momentum	1 day

Teacher Notes:

Additional Resources
 Click links below to access additional resources used to design this unit:

Unit Overview

Content Area: Science

Unit Title: Static Electricity & Electric Fields

Grade Level: 11/12

Unit Summary: This unit covers electrostatic forces and electric fields.

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.A, HS.PS2.B (HS-PS3-2),(HS-PS3-5), HS.PS3.A, HS.LS2.B (HS-PS3-1); HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST,11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.9, WHST.11-12.8, ETS1.B, ETS1-3, ETS1-4, ETS1.C MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3, HSA-CED.A.1, HSA-CED.A.2, HSA-CED.A.4, HSA-SSE.A.1, HSA-SSE.B.3, HSF-IF.C.7, HSS-ID.A.1

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross-Cutting Concepts

- Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.
- Cause and Effect: Mechanisms and Predictions
- Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.
- Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
- Structure and Function - The way an object is shaped or structured determines many of its properties and functions.
- Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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-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.
HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

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.

<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> · How do things become charged? · What are the differences between conductors and insulators? <ul style="list-style-type: none"> - How can you charge objects? - How do you measure an electric field? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · How objects become charged. · Objects that are conductors or insulators. - Electric Fields
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<p>Unit Learning Targets/Objectives:</p> <p><i>Students will...</i></p> <ul style="list-style-type: none"> · Learn that forces are both attractive & repulsive · Discuss the difference between conductors & insulators · Relate electrostatic force to the distance between charges · Compare & contrast charging by conduction vs. induction · Calculate force using Coulomb's Law · Define an electric field · Relate charge, electric field and forces <ul style="list-style-type: none"> - Diagram electric fields - Learn electric potential difference - Analyze properties of capacitors

Evidence of Learning

Formative Assessments: Tests

Summative/Benchmark Assessment(s): Worksheets, Q & A, Labs, homework, online activities

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulation>

Modifications: group problem solving, peer tutoring, modeling,

- **Special Education Students:**
 - Hands on lab activity
 - Cooperative learning
 - Peer tutoring
 - Extended time
- **English Language Learners:**
 - Hands-on activities & explanations
 - Assess comprehension through demonstration
 - Give instructions/directions in writing & orally
 - Use translation dictionaries to locate words in the native language
- **At-Risk Students:**
 - Hands on activity
 - cooperative learning
 - reteach in various methods
- **Gifted and Talented Students:**
 - Provide extension activities per student interest

Lesson Plans

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
Electric Charge	Attractive & Repulsive Forces	1 day
	Conductors & Insulators	1 day
	Electrostatic Force depends on distance between charges Coulomb's Law	2 days
	Charging by conduction/induction	1 day
Lab	Electrostatics	1 day
	Defining Electric Field	2 days
	Modeling Electric Fields	1 day
	Energy & Electric Potential	2 days

	Capacitors	2 days
	Phet Capacitor online lab	1 day

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview

Content Area: Science

Unit Title: Electric Current & Circuits

Grade Level: 11/12

Unit Summary: This unit covers electric current and circuits.

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST,11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.7, WHST.11-12.8, WHST.11-12.5

MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3

ETS1.B, ETS1-3, ETS1-4, ETS1.C

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross-Cutting Concepts

-Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.

-Cause and Effect: Mechanisms and Predictions

-Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

-Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

-Structure and Function - The way an object is shaped or structured determines many of its properties and functions.

-Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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-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.

<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> · What is electric current? · What is Ohm's Law? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · Types of circuits · How power is related to resistance, voltage and current

Unit Learning Targets/Objectives:

Students will...

- Discuss Electric Current
- Calculate Ohm's Law
- Relate power, current, potential difference and resistance mathematically
- Differentiate between series and parallel circuits
- Explain how currents, potential differences and resistances are related in a series circuit
- Explain how currents, potential differences and resistances are related in a parallel circuit
- Calculate a combined circuit

Evidence of Learning

Formative Assessments: Tests

Summative/Benchmark Assessment(s): Labs, Circuits, Worksheets, Q &A, homework

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulations>

<http://www.compadre.org/precollege/static/unit.cfm?sb=10&course=3&MID=123> (conceptual)

<http://www.compadre.org/precollege/static/unit.cfm?sb=10&course=4&MID=123> (algebra based)

Modifications: group problem solving, peer tutoring, modeling,

- | | |
|---|---|
| <ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity ● Cooperative learning ● Peer tutoring ● Extended time ● English Language Learners: | <ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity ● cooperative learning ● reteach in various methods ● Gifted and Talented Students: |
|---|---|

- **Hands-on activities & explanations**
 - **Assess comprehension through demonstration**
 - **Give instructions/directions in writing & orally**
 - **Use translation dictionaries to locate words in the native language**
- Provide extension activities per student interest

Lesson Plans

Lesson Name /Topic	Lesson Objective(s)	Time frame (day(s) to complete)
	Producing Electric Current and Electric Circuits Diagramming Circuits	3 days
	Electrical Energy transformed into thermal energy	1 day
	Relating Electrical Energy and Power	1 day
Lab	Building Circuits	2 days
	Characteristics of Series Circuits Calculating Resistance, Current and Voltage	2 days
	Characteristics of Parallel Circuits Calculating Resistance, Current and Voltage	2 days
	Household Circuits Combined Circuits	1 day
Lab	Physics Classroom	2 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview

Content Area: Science

Unit Title: Magnetic Fields

Grade Level: 11/12

Unit Summary: This unit covers magnetic and electromagnetic fields.

Interdisciplinary

Connections: HS.PS3.A, HS-PS3.C, HS-PS3.D, HS.ETS1.A, HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, SL.11-12.5, WHST.9-12.7, WHST.11-12.8, WHST.11-12.9, ETS1.B, ETS1-3, ETS1-4, ETS1.C

MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross-Cutting Concepts

-Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.

-Cause and Effect: Mechanisms and Predictions

-Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

-Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

-Structure and Function - The way an object is shaped or structured determines many of its properties and functions.

-Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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-PS3-1	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-PS3-5	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.

<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> · How do magnets work? · How do electromagnetic fields form? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · Magnetic Forces · Application of Induced Currents
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Unit Learning Targets/Objectives:

Students will...

- Learn properties of magnets
- Discuss characteristics of magnetic fields
- Relate magnetic fields and electric currents
- Analyze the force on current-carrying wire in a magnetic field
- Discuss how a generator produces electrical energy
- Analyze transformers
-

Evidence of Learning

Formative Assessments: Test

Summative/Benchmark Assessment(s): Worksheets, Q&A, exit slips, Internet activities, Labs, homework

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulations>

Modifications: group problem solving, peer tutoring, modeling,

- | | |
|---|--|
| <ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity ● Cooperative learning ● Peer tutoring ● Extended time
 ● English Language Learners: ● Hands-on activities & explanations ● Assess comprehension through demonstration ● Give instructions/directions in writing & orally ● Use translation dictionaries to locate words in the native language | <ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity ● cooperative learning ● reteach in various methods
 ● Gifted and Talented Students: ● Provide extension activities per student interest |
|---|--|

Teacher Notes:		
Additional Resources Click links below to access additional resources used to design this unit:		

Unit Overview
Content Area: Science
Unit Title: Vibrations & Waves
Grade Level: 11/12
<p>Unit Summary: This unit cover how waves and simple harmonic motion are examples of periodic motion.</p> <p>Interdisciplinary</p> <p>Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS-PS3.D, HS-PS4.A, HS-PS4.B, HS-PS4.C, HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST,11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.7, WHST.11-12.8, WHST.11-12.5</p> <p>MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3</p> <p>21st Century</p> <p>Themes and Skills: CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11</p> <p>Technology</p> <p>8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4</p> <p>NGSS: Cross-Cutting Concepts</p> <ul style="list-style-type: none"> -Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them. -Cause and Effect: Mechanisms and Predictions -Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. -Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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-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.

Unit Essential Question(s):

- What are waves?
- What Type of Waves exist?
 - How are waves reflected and refracted between mediums?

Unit Enduring Understandings:

- Characteristics of waves
- Waves in different mediums

Unit Learning Targets/Objectives:

Students will...

- Describe simple harmonic motion
- Discuss wave properties
- Compare & contrast transverse and longitudinal waves
- Relate wave speed, wavelength and frequency
- Analyze reflected and refracted waves between mediums
- Recognize different types of interference

Evidence of Learning

Formative Assessments: Test

Summative/Benchmark Assessment(s): Worksheets, Q&A, exit slips, Internet activities, Labs, Homework

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulations>

Modifications: group problem solving, peer tutoring, modeling,

- **Special Education Students:**
- **Hands on lab activity**
- **Cooperative learning**
- **Peer tutoring**
- **Extended time**
- **English Language Learners:**
- **Hands-on activities & explanations**
- **Assess comprehension through demonstration**
- **Give instructions/directions in writing & orally**
- **Use translation dictionaries to locate words in the native language**
- **At-Risk Students:**
- **Hands on activity**
- **cooperative learning**
- **reteach in various methods**
- **Gifted and Talented Students:**
- **Provide extension activities per student interest**

Lesson Plans

Lesson Name /Topic	Lesson Objective(s)	Time frame (day(s) to complete)
	Periodic Motion	2 days
	Wave Properties	2 days
	Wave Behavior	1 day

Lab	Wave Behavior Lab	1 day

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview

Content Area: Science

Unit Title: Sound

Grade Level: 11/12

Unit Summary: This unit covers the properties and detection of sound.

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS-PS3.D, HS-PS4.A, HS-PS4.B, HS-PS4.C, HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST.11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.7, WHST.11-12.8, WHST.11-12.5, ETS1-3
MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross-Cutting Concepts

-Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.

-Cause and Effect: Mechanisms and Predictions

Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

-Structure and Function - The way an object is shaped or structured determines many of its properties and functions.

-Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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-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.

<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> · How do the physical properties of sound waves relate to our perception of sound? · How do musical instruments resonate to make sound? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · How sound is made · How musical instruments work
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<p>Unit Learning Targets/Objectives:</p> <p><i>Students will...</i></p> <ul style="list-style-type: none"> · Describe properties sound waves share with other waves · Relate sound waves to perception of sound · Apply Doppler effect · Explain Resonance ·

Evidence of Learning

Formative Assessments: Test

Summative/Benchmark Assessment(s): Worksheets, Q&A, exit slips, Internet activities, Labs, homework

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulations>

http://www.unco.edu/nhs/physics/faculty/adams/Research/USB/Index_PS.htm

Modifications: group problem solving, peer tutoring, modeling,

- **Special Education Students:**
- Hands on lab activity
- Cooperative learning
- Peer tutoring
- Extended time
- At-Risk Students:
- Hands on activity
- cooperative learning
- reteach in various methods
- English Language Learners:
- Hands-on activities & explanations
- Assess comprehension through demonstration
- Give instructions/directions in writing & orally
- Use translation dictionaries to locate words in the native language
- Gifted and Talented Students:
- Provide extension activities per student interest

Lesson Plans

Lesson Name /Topic	Lesson Objective(s)	Time frame (day(s) to complete)
	Sound Waves	2 days
	Doppler Effect	1 day
	Resonance Physics of Music	2 days
Lab	Sound Waves	1 day
	Physics Classroom	2 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview

Content Area: Science

Unit Title: Light

Grade Level: 11/12

Unit Summary:

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS-PS3.D, HS-PS4.A, HS-PS4.B, HS-PS4.C, HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST,11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.7, WHST.11-12.8, WHST.11-12.5
MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross-Cutting Concepts

-Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.

-Cause and Effect: Mechanisms and Predictions

-Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

-Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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 about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
HS-ETS1-4	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.

<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> · What is the ray model of light and how are objects illuminated? · What is diffraction of light? <ul style="list-style-type: none"> - How do polarized sunglasses work? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · How objects are illuminated · Wave characteristics of light

<p>Unit Learning Targets/Objectives:</p> <p><i>Students will...</i></p> <ul style="list-style-type: none"> · Learn a ray model of light and illumination · Relate light with wave properties · Apply polarization to light · · 	
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Evidence of Learning

Formative Assessments: Test

Summative/Benchmark Assessment(s): Worksheets, Q&A, exit slips, Internet activities, Labs, homework

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt
Physics Principles & Problems by Zitzewitz, Haase, Harper
<http://www.physicsclassroom.com>
<https://phet.colorado.edu/en/simulations>

<p>Modifications: group problem solving, peer tutoring, modeling,</p>	
<ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity ● Cooperative learning ● Peer tutoring ● Extended time ● English Language Learners: ● Hands-on activities & explanations ● Assess comprehension through demonstration ● Give instructions/directions in writing & orally 	<ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity ● cooperative learning ● reteach in various methods ● Gifted and Talented Students: ● Provide extension activities per student interest

Teacher Notes:		
Additional Resources		
Click links below to access additional resources used to design this unit:		

Unit Overview

Content Area: Science

Unit Title: Mirrors

Grade Level: 11/12

Unit Summary: This unit covers plane, concave and convex mirrors and how images are formed.

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS-PS3.D, HS-PS4.A, HS-PS4.B, HS-PS4.C, HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST,11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.7, WHST.11-12.8, WHST.11-12.5
MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4

NGSS: Cross-Cutting Concepts

-Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.

-Cause and Effect: Mechanisms and Predictions

- Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.
- Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.
- Structure and Function - The way an object is shaped or structured determines many of its properties and functions.
- Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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 about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
HS-ETS1-4	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.

Unit Essential Question(s):	Unit Enduring Understandings:
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<ul style="list-style-type: none"> · What is the Law of Reflection · How are images formed in mirrors? <ul style="list-style-type: none"> - Plane Mirrors - Convex & Concave 	<ul style="list-style-type: none"> · Law of reflection · How images are formed in mirrors
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Unit Learning Targets/Objectives:

Students will...

- Learn the law of reflection
- Examine Characteristics of Plane Mirror Images
- Sketch Plane Mirror Images
- Compare & Contrast concave & convex mirrors
- Sketch ray diagrams of concave & convex mirrors
- Explore instrumentation using mirrors

Evidence of Learning

Formative Assessments: Test

Summative/Benchmark Assessment(s): Worksheets, Q&A, exit slips, Internet activities, Labs, homework

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulations>

Modifications: group problem solving, peer tutoring, modeling,

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| <ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity ● Cooperative learning ● Peer tutoring ● Extended time | <ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity ● cooperative learning ● reteach in various methods |
| <ul style="list-style-type: none"> ● English Language Learners: ● Hands-on activities & explanations ● Assess comprehension through demonstration ● Give instructions/directions in writing & orally ● Use translation dictionaries to locate words in the native language | <ul style="list-style-type: none"> ● Gifted and Talented Students: ● Provide extension activities per student interest |

Teacher Notes:		
Additional Resources		
Click links below to access additional resources used to design this unit:		

Unit Overview
Content Area: Science
Unit Title: Refractions & Lenses
Grade Level: 11/12
<p>Unit Summary: This unit covers how light is refracted and images are created.</p> <p>Interdisciplinary</p> <p>Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS-PS3.D, HS-PS4.A, HS-PS4.B, HS-PS4.C, HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.3, RST.11-12.4, RST.11-12.5, RST,11-12.6, RST.11-12.7, RST.11-12.8, RST.11-12.9, RST.11-12.10, WHST.9-12.7, WHST.11-12.8, WHST.11-12.5</p> <p>MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3</p> <p>21st Century</p> <p>Themes and Skills: CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11</p> <p>Technology</p> <p>8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4</p> <p>NGSS: Cross-Cutting Concepts</p> <ul style="list-style-type: none"> -Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them. -Cause and Effect: Mechanisms and Predictions -Scale, Proportion, and Quantity - In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change.

-Systems and System Mode is - A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems.

-Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
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 about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.
HS-ETS1-4	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.

Unit Essential Question(s):

- How is light refracted?
- How are real and virtual images formed?

Unit Enduring Understandings:

- Refraction of light
- How Lenses form images

Unit Learning Targets/Objectives:

Students will...

- Learn Snell's Law of Refraction

- Measure Index of Refraction
- Describe Total Internal Reflection
- Examine Convex and Concave Lenses
- Sketching Convex & Concave Images
- Explore Applications of Lenses
Lenses in Eyes, Telescopes, Cameras, Microscopes

Evidence of Learning

Formative Assessments: Test

Summative/Benchmark Assessment(s): Worksheets, Q&A, exit slips, Internet activities, Labs

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<http://www.physicsclassroom.com>

<https://phet.colorado.edu/en/simulations>

Modifications: group problem solving, peer tutoring, modeling,

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| <ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity ● Cooperative learning ● Peer tutoring ● Extended time
 ● English Language Learners: ● Hands-on activities & explanations ● Assess comprehension through demonstration ● Give instructions/directions in writing & orally ● Use translation dictionaries to locate words in the native language | <ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity ● cooperative learning ● reteach in various methods
 ● Gifted and Talented Students: ● Provide extension activities per student interest |
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Lesson Plans

Lesson Name /Topic	Lesson Objective(s)	Time frame (day(s) to complete)
	Snell's Law of Refraction	2 days

	Calculate Refraction	
	Total Internal Reflection, Mirages & Rainbows	1 day
	Convex Lenses	1 day
	Sketch diagrams of Convex Lense Images	2 days
	Concave Lenses	1 day
	Sketch diagrams of Concave Lenses	2 days
	Magnification Magnification Ratio (Physics Classroom Lab)	1 day
	Lenses in Eyes, Telescopes, Cameras, Microscopes	1 day
Lab	Lenses	2 days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

Unit Overview

Content Area: Science

Unit Title: Nuclear and Particle Physics

Grade Level: 11/12

Unit Summary: This unit covers isotopes, radioactive decay and half-lives of elements.

Interdisciplinary

Connections: HS.PS1.A (HS-PS3-2); HS.PS1.B (HS-PS3-1),(HS-PS3-2); HS.PS2.B (HS-PS3-2),(HS-PS3-5); HS.LS2.B (HS-PS3-1); HS.ESS1.A (HS-PS3-1),(HS-PS3-4); HS.ESS2.A (HS-PS3-1),(HS-PS3-2),(HS-PS3-4); HS.ESS2.D (HS-PS3-4); HS.ESS3.A (HS-PS3-3), RST.11-12.1, RST.11-12.7, RST,11-12.6, RST.9-10.7, RST.11-12.8, WHST.9-12.7, WHST.11-12.8, WHST.9-12.2

MP.4, HSN-Q.A.1, HSN-Q.A.2, HSN-Q.A.3

21st Century

Themes and Skills: **CRP1, CRP4, CRP5, CRP6, CRP8, CRP9, CRP11**

Technology

8.1.12.C.1, 8.1.12.E.1, 8.1.12.F.1, 8.2.12.B.4, 8.1.12.D.5

NGSS: Cross-Cutting Concepts

-Patterns- Observed patterns in nature guide organizations and classification and prompt questions about relationships and causes underlying them.

-Cause and Effect: Mechanisms and Predictions

-Energy and Matter

- Structure and Function - The way an object is shaped or structured determines many of its properties and functions.

-Stability and Change for both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Learning Targets

Standards (Content and Technology):

CPI#:	Statement:
HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> · What are isotopes? · What is radioactive decay and half-life? - What is nuclear fission and fusion? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> · How radioactive decay occurs · Where nuclear fission & fusion occurs
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<p>Unit Learning Targets/Objectives:</p> <p><i>Students will...</i></p> <ul style="list-style-type: none"> · Describe the properties of the nucleus of an atom · Define isotopes · Explain Nuclear Force · Compare and contrast types of radiation · Calculate half-life · Differentiate between nuclear fission and nuclear Fission · Differentiate between the four fundamental interactions

Evidence of Learning

Formative Assessments: Test

Summative/Benchmark Assessment(s): Worksheets, Q&A, exit slips, Internet activities, Labs

Resources/Materials (copy hyperlinks for digital resources):

Conceptual Physics by Hewitt

Physics Principles & Problems by Zitzewitz, Haase, Harper

<https://phet.colorado.edu/en/simulations>

Modifications: group problem solving, peer tutoring, modeling,

- | | |
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| <ul style="list-style-type: none"> ● Special Education Students: ● Hands on lab activity ● Cooperative learning ● Peer tutoring ● Extended time
 ● English Language Learners: ● Hands-on activities & explanations ● Assess comprehension through demonstration ● Give instructions/directions in writing & orally ● Use translation dictionaries to locate words in the native language | <ul style="list-style-type: none"> ● At-Risk Students: ● Hands on activity ● cooperative learning ● reteach in various methods
 ● Gifted and Talented Students: ● Provide extension activities per student interest |
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Lesson Plans

Lesson Name /Topic	Lesson Objective(s)	Time frame (day(s) to complete)
	Properties of an atom and nuclear force	1 day
	Radioactive decay and half life	2 days
	Nuclear fission	1 day
	Nuclear fusion	1 day

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit: