

SOUTHERN REGIONAL SCHOOL DISTRICT PHYSICS/HONORS PHYSICS CURRICULUM

Content Area: Science

Course Title: HONORS PHYSICS

Grade Level: 11/12

Unit Plan 1

MOTION

Unit Plan 2

**FORCES-NEWTON'S LAWS
MOMENTUM**

Unit Plan 3

PROJECTILE-CIRCULAR-PLANETS

Unit Plan 4

WORK-SIMPLE MACHINES-ENERGY

Unit Plan 5

ELECTRICITY MAGNETISIM

Unit Plan 6

WAVES-SOUND

Unit Plan 7

LIGHT-LENSES

Date Created: MARCH 14, 2011

Board Approved on:

Unit Overview

Content Area: PHYSICS

Unit Title: DESCRIBING MOTION

Target Course/Grade Level: 11/12

Unit Summary This unit is designed to give students an understanding of speed, velocity, and acceleration as related to moving objects.

Primary interdisciplinary connections: Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st century themes: The unit will integrate the 21st Century Life and Career strand 9.1 strands A-D. these strands include:

- **Critical Thinking and Problem Solving**
- **Creativity and Innovation**
- **Collaboration, Teamwork, and Leadership**
- **Cross-Cultural Understanding and Interpersonal Communication**
- **Communication and Media Fluency**
- **Accountability, Productivity, and Ethics**

Technology connections:

For further clarification refer to NJ Class Standard Introductions at www.njcccs.org.

Learning Targets

Content Standards

This unit will assimilate the four strands (A-D) of the Science Practices Standard 5.1.

These include:

- **Understanding scientific explanations**
- **Generating science through active investigation**
- **Reflecting on scientific knowledge**
- **Participating productively in science**

5.2 Physical Science: All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.

CPI #	Cumulative Progress Indicator (CPI)
5.1 A-D	Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be

	proficient in science.	
5.2.12.E.1	Compare the calculated and measured speed, average speed, and acceleration of an object in motion, and account for differences that may exist between calculated and measured values.	
Unit Essential Questions <ul style="list-style-type: none"> • What is a time interval? • What is speed? • What is velocity? • What is acceleration? 	Unit Enduring Understandings <i>Students will understand that...</i> <ul style="list-style-type: none"> • Speed is the ratio of distance covered and time. • Velocity is the ratio of displacement and time. • Velocity is a speed with direction. • Acceleration is any change in velocity. • Acceleration can be +, -, and/or changing direction. 	
Unit Objectives <i>Students will know...</i> <ul style="list-style-type: none"> • Vocabulary and key Terms • Essential laboratory equipment. • Graphs and particle models are used to represent motion. • The difference between a scalar and a vector. 	Unit Objectives <i>Students will be able to...</i> <ul style="list-style-type: none"> • Choose coordinate systems for motion problems • Differentiate between scalar and vector quantities. • Define a displacement vector and determine a time interval. • Relate the direction and magnitude of velocity and acceleration vectors to the motion of objects. • Create pictorial and physical models for solving motion problems. 	

Formative Assessments

For additional ideas please refer to NJ State DOE classroom application documents:

<http://njcccs.org/CADDownload.aspx>

- Observation
- Homework
- Class participation
- Graphs
- Laboratories/Lab Reports
- Notebook
- Writing Assignments

Summative Assessments

For additional ideas please refer to NJ State DOE Professional Education Port (PEP):

<http://www.state.nj.us/education/njpep/index.html>

- Chapter/Unit Test
- Writing Assignments
- Presentations
- Laboratory Practical
- Unit Projects
- Quarterly Exams
-

Modifications (ELLs, Special Education, Gifted and Talented)

- Follow all IEP modifications/504 plans

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

- **Textbook Physics Principles and Problems, Glencoe 2002**
- **Internet**
- **Lab Equipment**

Teacher Notes:

Unit Overview

Content Area: Physics

Unit Title: FORCES-NEWTON'S LAWS-MOMENTUM

Target Course/Grade Level: 11/12

Unit Summary This unit is designed to give students an understanding of forces applied to an object, and the resulting changes in speed velocity acceleration and momentum.

Primary interdisciplinary connections: Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st century themes: The unit will integrate the 21st Century Life and Career strand 9.1 strands A-D. these strands include:

- **Critical Thinking and Problem Solving**
- **Creativity and Innovation**
- **Collaboration, Teamwork, and Leadership**
- **Cross-Cultural Understanding and Interpersonal Communication**
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Learning Targets

Content Standards

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5.2.12.D.4	Measure quantitatively the energy transferred between objects during a collision.
5.2.12.E.2	Compare the translational and rotational motions of a thrown object and potential applications of this understanding.
5.2.12.E.3	Create simple models to demonstrate the benefits of seatbelts using Newton's first law of motion.
5.2.12.E.4	Measure and describe the relationship between the force acting on an object and the resulting acceleration.

<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • What is a force? • How do seatbelts save lives? • What changes the momentum of an object? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Contact and long-range forces are different. • Advancements in seatbelts and other supplemental restraints save lives and reduce injuries. • An unbalanced force will change the momentum of an object • Friction is part of everyday life. • Internal and external forces effect and object differently.
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key Terms • Essential laboratory equipment. • Newton’s 3 Laws of Motion • Law of conservation of momentum • The benefits and drawbacks of friction. • Coefficient of friction depends on the surfaces in contact. • Weight is dependent on mass and gravity. 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • List and apply Newton’s Laws • Recognize that friction is often disregarded. • Identify static and kinetic friction. • Determine the direction of frictional forces. • Apply the law of conservation of momentum. • Differentiate between mass and weight. • Calculate the coefficient of friction. • Define and calculate impulse.

Formative Assessments

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Modifications (ELLs, Special Education, Gifted and Talented)

- Follow all IEP modifications/504 plans

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

- **Textbook Physics Principles and Problems, Glencoe 2002**
- **Internet**
- **Lab Equipment**

Teacher Notes:

Unit Overview

Content Area: Physics

Unit Title: PROJECTILE-CIRCULAR-PLANETS

Target Course/Grade Level: 11/12

Unit Summary This unit is designed to give students an understanding of 2 dimensional motion, including: projectile, circular and planetary motion.

Primary interdisciplinary connections: Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st century themes: The unit will integrate the 21st Century Life and Career strand 9.1 strands A-D. these strands include:

- **Critical Thinking and Problem Solving**
- **Creativity and Innovation**
- **Collaboration, Teamwork, and Leadership**
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Learning Targets

Content Standards

CPI #	Cumulative Progress Indicator (CPI)
5.1 A-D	Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
5.2.12.E.2	Compare the translational and rotational motions of a thrown object and potential applications of this understanding.
5.2.12.E.4	Measure and describe the relationship between the force acting on an object and the resulting acceleration.
5.4.12.A.2	Collect, analyze, and critique evidence that supports the theory that Earth and the rest of the solar system formed from a nebular cloud of dust and gas 4.6 billion years ago.
5.4.12.A.4	Analyze simulated and/or real data to estimate the number of stars in our galaxy and the number of galaxies in our universe.

5.4.12.A.5	Critique evidence for the theory that the universe evolved as it expanded from a single point 13.7 billion years ago.
5.4.12.A.6	Argue, citing evidence (e.g., Hubble Diagram), the theory of an expanding universe.
<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • How do gravity and air resistance affect the motion of a projectile? • What variables effect a trajectory? • How is planetary motion similar to projectile motion? • What is gravity? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Trajectories are parabolic. • Planets travel in elliptical paths. • Range can be predicted. • Air resistance must be accounted for. • Big Bang is the currently accepted theory of the origin of the universe. • Gravity is the predominant cause of changes in our universe.
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key Terms • Essential laboratory equipment. • Range is affected by angle of launch, initial velocity and launch height. • Aerodynamics and gravity affect range. • Tilt angle of Earth's rotational axis determines our seasons. • Gravity exists between all objects that have mass. 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Predict the range of a projectile • Relate seasons to the angle of Earth's rotational axis. • Accurately launch projectiles to a predetermined range. • Describe how air resistance and aerodynamics influence trajectory. • Identify forces acting on an object at terminal velocity.

Formative Assessments

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Modifications (ELLs, Special Education, Gifted and Talented)

- Follow all IEP modifications/504 plans

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

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Teacher Notes:

Unit Overview

Content Area: Physics

Unit Title: WORK-SIMPLE MACHINES-ENERGY

Target Course/Grade Level: 11/12

Unit Summary This unit is designed to give students an understanding of 2 dimensional motion, including: projectile, circular and planetary motion.

Primary interdisciplinary connections: Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st century themes: The unit will integrate the 21st Century Life and Career strand 9.1 strands A-D. these strands include:

- **Critical Thinking and Problem Solving**
- **Creativity and Innovation**
- **Collaboration, Teamwork, and Leadership**
- **Cross-Cultural Understanding and Interpersonal Communication**
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Technology connections:

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Learning Targets

Content Standards

CPI #	Cumulative Progress Indicator (CPI)
5.1 A-D	Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
5.2.12.D.1	Model the relationship between the height of an object and its potential energy.

Unit Essential Questions

- **What is energy?**
- **How are energy and matter related?**
- **How are simple machines and work related?**
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Unit Enduring Understandings

Students will understand that...

- **Simple machines typically make work easier.**
- **Energy cannot be created or destroyed.**
- **Roller coasters model the law of conservation of energy.**

<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none">• Vocabulary and key Terms• Essential laboratory equipment.• Simple machines can provide mechanical advantage.• Law of conservation of energy.• How energy can be defined in terms of work.	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none">• Calculate mechanical, potential and kinetic energy.• Apply the law of conservation of energy.• Calculate efficiency of a system.• Identify simple machines• List manifestations of lost energy in a system.
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Formative Assessments

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Modifications (ELLs, Special Education, Gifted and Talented)

- Follow all IEP modifications/504 plans

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

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Teacher Notes:

Unit Overview

Content Area: Physics

Unit Title: ELECTRICITY MAGNETISM

Target Course/Grade Level: 11/12

Unit Summary This unit is designed to give students an understanding electromagnetic fields and related forces, as well as electric circuits.

Primary interdisciplinary connections: Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st century themes: The unit will integrate the 21st Century Life and Career strand 9.1 strands A-D. these strands include:

- **Critical Thinking and Problem Solving**
- **Creativity and Innovation**
- **Collaboration, Teamwork, and Leadership**
- **Cross-Cultural Understanding and Interpersonal Communication**
- **Communication and Media Fluency**
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Technology connections:

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Learning Targets

Content Standards

CPI #	Cumulative Progress Indicator (CPI)
5.1 A-D	Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
5.2.12.A.1	Use atomic models to predict the behaviors of atoms in interactions.
5.2.12.B.1	Model how the outermost electrons determine the reactivity of elements and the nature of the chemical bonds they tend to form.
5.3.12.B.1	Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.

<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • What are magnetic fields? • What are electric fields? • How is electrical energy stored and transferred? • 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Electrons are the part of the atom that is moving. • The outermost electrons are the particles that carry charge. • Electricity and magnetism are inter-related. • Batteries are stored chemical potential energy
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key Terms • Essential laboratory equipment. • Similarities and differences between electric and magnetic fields • Forces due to E_{fields} and B_{fields} are inversely proportionate to distance. • Fundamental wiring of a household circuit. • Ohm's law 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Diagram electric and magnetic fields • Predict forces between charged objects and magnetic poles. • Build series and parallel electrical circuits • Describe conditions for flow of charge. • Describe the magnetic field of the Earth. • Use Ohm's law to calculate variables for a simple circuit. • Differentiate between AC and DC.

Formative Assessments

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Modifications (ELLs, Special Education, Gifted and Talented)

- Follow all IEP modifications/504 plans

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

- **Textbook Physics Principles and Problems, Glencoe 2002**
- **Internet**
- **Lab Equipment**

Teacher Notes:

Unit Overview

Content Area: Physics

Unit Title: WAVES-SOUND

Target Course/Grade Level: 11/12

Unit Summary This unit is designed to give students an understanding of the concept of wave motion and the properties of waves.

Primary interdisciplinary connections: Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st century themes: The unit will integrate the 21st Century Life and Career strand 9.1 strands A-D. these strands include:

- **Critical Thinking and Problem Solving**
- **Creativity and Innovation**
- **Collaboration, Teamwork, and Leadership**
- **Cross-Cultural Understanding and Interpersonal Communication**
- **Communication and Media Fluency**
- **Accountability, Productivity, and Ethics**

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Learning Targets

Content Standards

CPI #	Cumulative Progress Indicator (CPI)
5.1 A-D	Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.
5.2.12.A.2	Account for the differences in the physical properties of solids, liquids, and gases.
5.2.12.E.1	Compare the calculated and measured speed, average speed, and acceleration of an object in motion, and account for differences that may exist between calculated and measured values.
5.3.12.B.1	Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.

<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • What is a wave? • How do waves transfer energy? • What is the range of human hearing? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Wave behavior is used to categorize energy transfer. • Earthquakes produce a variety of types of waves. • Wave behavior is one of two scientific theories used to explain light.
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key Terms • Essential laboratory equipment. • The difference between a longitudinal and a surface wave. • Wave properties. • Sound is a mechanical wave. • Studies of earthquakes have given clues about the physical composition of the inner Earth. 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Differentiate longitudinal, transverse, and surface waves. • Differentiate between mechanical and electromagnetic waves. • Identify a standing wave and its applications. • Explain causes of hearing loss.

Formative Assessments

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Modifications (ELLs, Special Education, Gifted and Talented)

- Follow all IEP modifications/504 plans

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

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- **Internet**
- **Lab Equipment**

Teacher Notes:

Unit Overview

Content Area: Physics

Unit Title: LIGHT-LENSES

Target Course/Grade Level: 11/12

Unit Summary This unit is designed to give students an understanding the basic properties of light, its behavior at a boundary, and application to optics.

Primary interdisciplinary connections: Infused within the unit are connection to the 2009 NJCCCS for Mathematics, Language Arts Literacy and Technology.

21st century themes: The unit will integrate the 21st Century Life and Career strand 9.1 strands A-D. these strands include:

- **Critical Thinking and Problem Solving**
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5.3.12.B.1	Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.
5.4.12.A.1	Explain how new evidence obtained using telescopes (e.g., the phases of Venus or the moons of Jupiter) allowed 17th-century astronomers to displace the geocentric model of the universe.

Unit Essential Questions

- **What is light?**
- **How do mirrors and lenses work?**

Unit Enduring Understandings

Students will understand that...

- **Light can be described by both wave models and particle models.**

<ul style="list-style-type: none"> • How does the human eye work? • How do telescopes and microscopes work? 	<ul style="list-style-type: none"> • The human visible light spectrum is only a tiny portion of the electromagnetic spectrum. • Nothing travels faster than the speed of light. • Light affects our daily lives
<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • Vocabulary and key Terms • Essential laboratory equipment. • The electromagnetic spectrum. • Much of our knowledge of the universe comes from our study of light. • Parts of the human eye. • How light affects our daily lives. 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Apply Snell's law • Describe similarities and differences between E & M waves. • Identify the parts of the human eye. • Use the law of reflection • Draw ray diagrams for mirrors and lenses.

Formative Assessments

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