STRATFORD PUBLIC SCHOOLS
Stratford, Connecticut

"Tantum eruditi sunt liberi"
Only the Educated Are Free

Physics
Grades 11-12

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Adopted by the Board of Education – June 2010

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DISTRICT MISSION

The mission of the Stratford Public Schools is to develop a community of learners in which students acquire the knowledge, skills and confidence to meet the challenges of a changing and increasingly diverse 21st century society.

DISTRICT CORE VALUES

Students will acquire content knowledge, strengthen higher-order thinking, and develop character in order to address 21st century challenges.

BUNNELL HIGH SCHOOL BELIEFS

We believe teachers must work collaboratively in support of student learning and to model collaboration as a social skill with students. We believe that a rigorous curriculum for all students, an acceptance of diversity, and a culture that actively welcomes all learners will contribute to a more knowledgeable community and society. We believe in the value of a strong education as a means of preparing students for work and life in the remainder of the 21st century.

STRATFORD HIGH SCHOOL BELIEFS

- a safe, positive school climate that embraces diversity is essential to ensure respect and opportunity for each individual
- students should understand the world beyond their community in order to contribute to a global society
- parents and students must share responsibility and work in partnership with the school in order to improve academic performance and to develop lifelong learners
- students should use technology effectively to acquire, process, and deliver information

BUNNELL HIGH SCHOOL and STRATFORD HIGH SCHOOL LEARNING EXPECTATIONS

All students will…

- use real-world digital and other research tools to access, evaluate and effectively apply information appropriate for authentic tasks. (Academic)
- work independently and collaboratively to solve problems and accomplish goals. (Civic-Social)
- communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes. (Academic)
- demonstrate innovation, flexibility and adaptability in thinking patterns, work habits and working/learning conditions. (Academic)
- effectively apply the analysis, synthesis and evaluation processes that enable productive problem solving. (Academic)
- value and demonstrate personal responsibility, character, cultural understanding and ethical behavior. (Civic-Social)
- show competence in all core academic subjects and other fields of interest, including the ability to clearly and effectively communicate content information in multiple formats. (Academic)

Stratford Information Literacy and Technology Standards

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

Essential Understanding:

Intelligent decision-making is based on recognizing the need and applying appropriate strategies for accessing information.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Essential Understanding:

All information is not equal.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Essential Understanding:

The effective communication of ideas and information is influenced by the use of appropriate formats.

Standard 4: Literacy and Literary Appreciation

Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Essential Understanding:

Reading provides a variety of benefits and advantages.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Essential Understanding:

Successful learning requires self-evaluation and discipline

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Stratford Public Schools

Essential Understandings for Physics

Physics – Kinematics

Essential Understanding#1: ***Unit: Linear Motion***
The motion of an object can be described by time rates of change. Motion can be described through graphical analysis.

Essential Understanding #2: ***Unit: Vectors***
Quantities can be either vectors or scalars. Perpendicular vectors are independent of each other.

Essential Understanding #3: ***Unit: Motion in Two-dimensions (Projectile Motion)***
The independent and different nature of vertical and horizontal components of motion contribute to the parabolic path of a projectile.

Physics – Dynamics

Essential Understanding #4: ***Unit: Newton's Laws***
A non-zero net force is required to have a change in the state of motion of an object. Objects change motion only when a net force is applied. Laws of motion are used to explain the effects of forces on the motion of objects.

Essential Understanding #5: ***Unit: Motion in Two-dimensions (Circular Motion)***
Circular motion is the result of a center-seeking force.

Essential Understanding #6: ***Unit: Gravitation***
Gravitation is the result of the attraction between all mass/matter.

Physics – Energy and Momentum

Essential Understanding 7: ***Unit: Mechanical Energy and Work and Unit: Thermal Energy***
Energy cannot be created or destroyed. The total mass and energy of the universe is constant. Energy can be transferred from one form to another by doing work.

Essential Understanding #8: ***Unit: Impulse and Momentum***
Impulse can result in a change in momentum. In a close isolated system, interactions between objects result in no net change in momentum.

Physics – Waves

Essential Understanding #9: ***Unit: Waves and Sound***
Waves are nature's way of transferring energy without transferring matter. There are a variety of wave types and classifications. Waves have predictable characteristics and behaviors.

Essential Understanding #10: ***Unit: Light and Color ,Unit; Quantum Theory and Unit :Optics***
Light is a phenomena that has both wave and particle behaviors.

Physics – Electricity & Magnetism

Essential Understanding 11: ***Unit: Electrostatics and Electric Fields***
An electric force is a universal force that exists between any two charged objects. All charged objects have electric fields.

Essential Understanding 12: ***Unit: Current Electricity***
Electric current is the result of moving charged particles.

Essential Understanding #13: ***Unit: Magnetism and Unit: Electromagnetic Induction***
Moving electric charges produce magnetic fields, and moving magnets produce electric forces.

Stratford Information Literacy and Technology Standards

Standard 1: Information Strategies

Students determine their need for information and apply strategies to select, locate, and access information resources.

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Standard 4: Literacy and Literary Appreciation

Students extract meaning from fiction and non-fiction resources in a variety of formats. They demonstrate an enjoyment of reading, including an appreciation of literature and other creative expressions.

Standard 5: Personal Management

Students display evidence of ethical, legal, and social responsibility in regard to information resources and project and self-management.

Safety In The Science Laboratory

Students and teachers must be aware of the potential for safety problems in the science classrooms and laboratories. Schools should review available safety resources and develop safety training for their teachers and students as well as safety rules for the classroom.

Teachers must choose safe labs that cover important concepts. Thought must be given to the chemicals purchased by schools. Which chemicals are the safest for the proposed labs, how much is needed, where will the chemicals be stored and in what arrangement? Are the storage areas locked and well ventilated?

General Lab Safety Recommendations

1. Always perform an experiment or demonstration prior to allowing students to replicate the activity. Look for possible hazards. Alert students to potential dangers.
2. Safety instructions should be given orally and be posted each time an experiment is begun.
3. Constant surveillance and supervision of student activities are essential.
4. Never eat or drink in the laboratory or from laboratory equipment. Keep personal items off the lab tables.

5. Never use mouth suction in filling pipettes with chemical reagents. Use a suction bulb.

General Science Safety Checklist

The following is a suggested checklist of safety concerns in K-12 science laboratories.

1. Appropriate protective equipment for the science laboratory
2. Enforcement of safety procedures
3. All students and teachers know the location of all protective equipment
4. All students read and sign a lab safety contract.
5. Sufficient, accessible lab stations per number of students in each laboratory
6. All students must wear proper safety goggles whenever chemicals, glassware, or heat are used

No food products should be consumed by staff or students as part of a lesson, unit or related course work.

Stratford Public Schools
Physics

Unit Name: Kinematics	Est. # of Weeks: 8 weeks
Synopsis: Motion can be represented with calculations, diagrams, and graphs.	
STUDENT LEARNING GOALS	
Content-Specific Powered Standards ▪ Motion can be visually represented through diagrams and graphs. ▪ Equations can be used to solve speed, velocity, distance, and time for an object in motion. ▪ All physical quantities are either vectors or scalars.	**Interdisciplinary Standards (as appropriate)** **Standard 2: Information Use** Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests. **Standard 3: Information and Technology Application** Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information. --- **Key Vocabulary**

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Distance
Displacement
Speed
Velocity
Acceleration
Free fall
Vector
Scalar
Resultant
Component
Projectile
Range

Enduring Understandings

The motion of an object can be described by time rates of change.
Motion can be described through graphical analysis.
Quantities can be either vectors or scalars.
Perpendicular vectors are independent of each other.
The independent and different nature of vertical and horizontal components of motion contribute to the parabolic path of a projectile.

Essential Questions

1. What are ways to describe how objects move?

Learning Objectives / Grade Level Expectations

Students will:

1. Manipulate appropriate equations to solve problems for motion and force.
2. Describe a Frame of Reference.
3. Draw particle models that represent various motion problems.
4. Describe the meaning of uniform motion.
5. Manipulate the speed formula to solve for speed, distance, or time.
6. Draw and analyze motion diagrams to illustrate and objects position and displacement.
7. Compare and contrast a vector (velocity) versus a scalar (speed).
8. Compare and contrast displacement versus distance.
9. Interpret graph solving for an objects position and displacement.
10. Calculate average velocity using velocity formula.
11. Calculate average velocity from various time graphs.

12. Perform acceleration calculations with appropriate units.
13. Pictorially demonstrate positive and negative acceleration.
14. Draw and analyze velocity-time graphs.
15. Compare and contrast average and instantaneous acceleration.
16. Compare and interpret acceleration graphs.
17. Research and demonstrate acceleration due to gravity.
18. Draw and calculate free fall problems in an ideal environment.
19. Draw a picture of an object in motion illustrating appropriate variables.
20. Use appropriate equations to solve motion problems.

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
Homework Problem Sets Topic Quizzes Unit Tests CFA #1, 2 Laboratory Experiments	Pre-Test CFA #1, 2 Midterm

LEARNING PLAN COMPONENTS

Acceleration Due to Gravity Benchmark Activity
50- meter Dash Lab
Constant Velocity Lab
Constant Acceleration Lab

Unit Name: Dynamics Est. # of Weeks: 8 weeks

Synopsis: An object's motion is influenced by applied forces.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- When forces are balanced, no acceleration occurs; thus an object continues to move at a constant speed or stays at rest.
- The law $F = ma$ is used to solve motion problems that involve constant forces.
- When one object exerts a force on a second object, the second object always exerts a force of equal magnitude and in the opposite direction.
- All masses are gravitationally attracted to each other.
- Applying a force to an object perpendicular to the direction of its motion causes the object to change direction.
- Circular motion requires the application of a constant force directed toward the center of the circle.

<u>21st Century Skills</u>

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (as appropriate)

Standard 2: Information Use
Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application
Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary
Action reaction pair
Equilibrium
Free-body diagram
Force
Friction
Inertia
Kilogram
Law of inertia
Mass
Net force
Newton
Newton's Laws
Normal force
Terminal velocity
Weight

Enduring Understandings	**Essential Questions**

A non –zero force is required to have a change in the state of motion of an object. Objects change motion only when a net force is applied. Laws of motion are used to explain the effects of forces on the motion of objects. Circular motion is the result of a center-seeking force. Gravitation is the result of the attraction between all mass/matter.	1. How can an object's motion be changed?

Learning Objectives / Grade Level Expectations
Students will:

1. Draw models that represent various force problems.
2. Describe the difference between mass and weight.
3. Manipulate the inertia formula to solve for weight, mass, or gravity.
4. Define Newton's 1st Law of Motion.
5. Provide an example of how Newton's 1st Law applies to their everyday life.
6. Draw models that represent various force problems.
7. Manipulate the force formula to solve for force, mass, or acceleration.
8. Define Newton's 2nd Law of Motion.
9. Provide an example of how Newton's 2nd Law applies to their everyday life.
10. Describe how Newton's 2nd Law applies to friction.
11. Define the normal force and determine the value of the normal force by applying Newton's 2nd Law.
12. Draw models that explain unbalanced forces such as tension in ropes or springs.
13. Define Newton's 3rd Law of Motion.
14. Provide an example of how Newton's 3rd Law applies to their everyday life.
15. Summarize how Newton's 3rd Law of Motion applies to conservation of motion.
16. Draw and label a picture describing the motion that results when new forces are applied to a moving object.
17. Demonstrate and calculate the vertical and horizontal components of projectile motion.
18. Evaluate the resultant or the sum of two or more vectors in two dimensions graphically.
19. Explain why an object moving in a circle at constant speed is accelerated.
20. Demonstrate how centripetal acceleration depends upon the object's speed and the radius of the circle.
21. Explain the meaning of the centrifugal force and why it is called a fictitious force.

ASSESSMENT PLAN

Summative Assessment (s)	**Formative and Diagnostic Assessment(s)**
Homework Problem Sets Topic Quizzes	Pre-Test CFA #3 & #4

Unit Tests Laboratory Experiments	Mid-term Exam

LEARNING PLAN COMPONENTS

Newton's Second Law Lab
Friction Benchmark Activity
Circular Motion Lab

Unit Name: Conservation of Energy and Momentum Est. # of Weeks: 8 weeks

Synopsis: The laws of conservation of energy and momentum provide a way to predict and describe the movement of objects. In many processes energy is transferred into the environment as heat.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- Kinetic energy can be calculated by using the formula $E = (1/2)mv^2$.
- Changes in gravitational potential energy near Earth can be calculated by using the formula (change in potential energy) = mgh.
- Momentum is calculated as the product mv.
- Momentum is a separately conserved quantity different from energy.
- An unbalanced force on an object produces a change in its momentum.
- The principles of conservation of momentum and energy can be used to solve problems involving elastic and inelastic collisions.
- Heat flow and work are two forms of energy transfer between systems.
- The internal energy of an object includes the energy of random motion of the object's atoms and molecules. The greater the temperature of the object, the greater the energy of motion of the atoms and molecules that make up the object.
- Most processes tend to decrease the order of a system over time, so that energy levels eventually are distributed more uniformly.

Interdisciplinary Standards (as appropriate)

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary
Impulse
Momentum
Elastic collision
Inelastic collision
Conservation of Momentum
Work
Power
Mechanical advantage
Efficiency
Kinetic Energy
Potential Energy
Conservation of Energy
Work-Energy Theorem
Heat
Temperature
Absolute zero
Specific heat

21st Century Skills **1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.** **2. Work independently and collaboratively to solve problems and accomplish goals.** **3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.** **4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.** **5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.** **6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.**	Thermal equilibrium Conduction Convection radiation Conductor Insulator Phase Liquid Solid Gas Plasma Boiling Condensation Evaporation Freezing Entropy
Enduring Understandings Energy cannot be created or destroyed. The total mass and energy of the universe is constant. Energy can be transferred from one form to another by doing work. Impulse can result in a change in momentum. In a closed isolated system, interactions between objects result in no net change in momentum or energy.	**Essential Questions** 1. Why does an automobile crumble in an accident? 2. What happens to the potential and kinetic energy in a collision? 3. How is motion affected by an object's mass? 4. Why does an ice cube melt? 5. If the efficiency of a gasoline engine is 25%, what happens to the rest of the energy stored in the gasoline?

Learning Objectives / Grade Level Expectations

Students will:

1. Manipulate the kinetic energy formula to solve for energy, mass, or velocity.
2. Provide examples of how kinetic energy applies to everyday life.
3. Analyze collisions to find the change in kinetic energy.
4. Manipulate the potential energy formula to solve for energy, mass, or velocity.
5. Provide examples of how potential energy applies to their everyday life.
6. Define the Law of Conservation of Energy and how it applies to real world applications.
7. Define the mechanical energy of a system and explain how mechanical energy is "lost".
8. Display an understanding that scientific work is energy transferred to or from an object by means of a force acting on the object. ($W=Fd=\Delta KE$)
9. Manipulate the Momentum formula to solve for momentum, mass, or velocity.
10. State the law of conservation of momentum and recognize the conditions under which momentum is conserved (example when a fire-cracker explodes).
11. Relate Newton's third law to the conservation of momentum.
12. Explain how an unbalanced force acting on an object over an interval of time produces a change in momentum, and manipulating the formula ($F\Delta t=m\Delta v$) to solve for force, time, mass, and/or velocity.
13. Explain how real world problems, such as air bags in cars, use the impulse momentum theorem

($F\Delta t=m\Delta v$) to decrease the impact force.

14. Using real world examples, analyze collisions to explain how the principles of conservation of momentum and energy can be used to solve problems involving elastic and inelastic collisions in one dimension.
15. Explain how the energy of a system can change either via work or via heat.
16. Compare and contrast the transfer of thermal energy by conduction, convection and radiation.
17. Explain the application of conservation of energy to heat transfer.
18. Explain specific heat and use it to calculate heat transfer with the equation: $Q=mC(T_f - T_i)$
19. Define heats of fusion and vaporization.
20. Demonstrate an understanding that entropy is a quantity that measures the order or disorder of a system and that this quantity is larger for a more disordered system.

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
Homework Problem Sets Topic Quizzes Unit Tests Laboratory Experiments	Pre-Test CFA #5, 6 Midterm Exam (Momentum) Final Exam (Mechanical and Thermal Energy)

LEARNING PLAN COMPONENTS

Work = change in energy lab
Conservation of energy
Specific heat lab
Heat of fusion lab

Unit Name: Wave Production and Transmission Est. # of Weeks: 8 weeks

Synopsis: Waves have characteristic properties that do not depend on the type of wave.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

- Waves carry energy from one place to another.
- Transverse and longitudinal waves exist in mechanical media, such as springs and ropes, and in the Earth as seismic waves.
- Wavelength, frequency and wave speed are related.
- Sound is a longitudinal wave whose speed depends on the properties of medium in which it propagates.
- Radio waves, light and X-rays are different wavelength bands in the spectrum of electromagnetic waves, the speed of which is in a vacuum is approximately 3×10^8 m/s, and less when passing through other media.
- Waves have characteristic behaviors, such as interference, diffraction, refraction and polarization.
- Beats and the Doppler Effect result from the characteristic behavior of waves.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply

Interdisciplinary Standards (as appropriate)

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary

Amplitude
Antinodes
Constructive Interference
Crest
Destructive interference
Doppler effect
Frequency
Hertz
In phase
Interference
Longitudinal wave
Node
Out of phase
Period
Simple harmonic motion
Standing waves
Transverse waves
Trough

information appropriate for authentic tasks. **2. Work independently and collaboratively to solve problems and accomplish goals.** **3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.** **4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.** **5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.** **6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.**	Vibration Wave Wavelength Beats Compression Natural frequency Pitch Rarefaction Resonance Critical angle Diffraction Law of Refraction Normal Total internal reflection

Enduring Understandings Waves are nature's way of transferring energy without transferring matter. There are a variety of wave types and classifications. Wave have predictable characteristics and behaviors. Light is a phenomena that has both wave and particle behaviors.	**Essential Questions** How do sound waves and light waves travel?

Learning Objectives / Grade Level Expectations
Students will:

1. Identify how waves transfer energy without transferring matter.
2. Contrast transverse and longitudinal waves.
3. Describe the force in an elastic spring.
4. Calculate wavelength problems using the formula $\lambda = {}^{v}/_{f}$.
5. Calculate frequency problems using the formula $f = {}^{1}/_{T}$.
6. Calculate wave speed problems using the formula $v = {}^{\lambda}/_{t}$. (includes speed of light)
7. Relate a waves speed through the medium in which the wave travels.
8. Describe how electromagnetic waves propagate through space.
9. Relate frequency to electromagnetic waves through different media.
10. Describe how waves are reflected and refracted at boundaries between media.
11. Apply the principle of superposition to the phenomenon of interference.
12. Explain phenomena such as polarization and Doppler Effect.

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
Homework Problem Sets	Pre-Test

Topic Quizzes Unit Tests Laboratory Experiments	CFA #7 Final Exam
LEARNING PLAN COMPONENTS	
Waves Lab Ripple Tank Lab Reflection Lab Refraction Lab	

Unit Name: Electric and Magnetic Phenomena — Est. # of Weeks: 8 weeks

Synopsis: Electric and Magnetic Fields are used in everyday devices.

STUDENT LEARNING GOALS

Content-Specific Powered Standards

The voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors can be predicted using Ohm's Law.

Any resistive element in a DC circuit dissipates energy, which heats the resistor.

21st Century Skills

1. Use real-world digital and other research tools to access, evaluate, and effectively apply information appropriate for authentic tasks.
2. Work independently and collaboratively to solve problems and accomplish goals.
3. Communicate information clearly and effectively using a variety of tools/media in varied contexts for a variety of purposes.
4. Demonstrate innovation, flexibility, and adaptability in thinking patterns, work habits, and working/learning conditions.
5. Effectively apply the analysis, synthesis, and evaluative processes that enable productive problem solving.
6. Value and demonstrate personal responsibility, character, cultural understanding, and ethical behavior.

Interdisciplinary Standards (as appropriate)

Standard 2: Information Use

Students evaluate, analyze, and synthesize information and data to solve problems, conduct research, and pursue personal interests.

Standard 3: Information and Technology Application

Students use appropriate technologies to create written, visual, oral and multimedia products that communicate ideas and information.

Key Vocabulary

Charge
Conductor
Conservation of charge Coulomb's Law
Coulomb
Grounding
Induction Insulator
Electric Field
Electric Potential
Electric potential energy
Volt
Ampere Direct current
Electric current
Electric power
Electric resistance
Ohm
Ohm's Law
Potential difference
Voltage source
Watt
Circuit
Parallel and series circuits
Magnetic domain
Magnetic field
Electromagnetic induction
Faraday's Law

Enduring Understandings

- An electric force is a universal force that exists between any two charged objects. All charged objects have electric fields.
- Electric current is the result of moving charged particles.
- Moving electric charges produce magnetic fields, and moving magnets produce electric forces.
- The power in any resistive circuit element can be calculated by using the power formula $P = I^2R$
- Charged particles are sources of electric fields and

Essential Questions

1. How are magnets used in machines or systems such as loud speakers, motors, and televisions?
2. How do magnets and electricity create different fields, and how do they interact?

are subject to the forces of the electric fields from other charges.

Enduring Understandings continued

- Magnetic materials and electric currents (moving electric charges) are sources of magnetic fields and are subject to forces arisen from the magnetic fields of other sources.
- Plasmas, the fourth state of matter, contain ions, or free electrons or both and conduct electricity.

Learning Objectives / Grade Level Expectations
Students will:

1. Solve problems involving current potential difference, and resistance using the formula V=IR.
2. Diagram simple circuits.
3. Describe the function of a resistor in a circuit.
4. Calculate power in a resistive circuit using the formula $P = I^2R$.
5. Relate electric fields to electric forces and distinguish between them.
6. Relate electric potential difference to work and energy.
7. Describe how changing magnetic fields can generate electric potential differences.
8. Relate electromagnetic induction to the direction of the force on a current-carrying wire in a magnetic field.
9. Solve problems involving magnetic field strength and the forces on current-carrying wire (F=ILB) and on moving charged particles in a magnetic field (F=qvB).
10. Describe the properties of Plasma.
11. Identify common plasmas outside of the laboratory.

ASSESSMENT PLAN

Summative Assessment(s)	**Formative and Diagnostic Assessment(s)**
Homework Problem Sets Topic Quizzes Unit Tests Laboratory Experiments	Pre-Test CFA #8 Final Exam

LEARNING PLAN COMPONENTS

Ohm's Law Lab
Series Circuits Lab
Parallel Circuits Lab

Staff can appropriately adjust length of time given to teaching skills and content to meet the needs of students without compromising the pace of the curriculum. *(Adopted BOE, 6/26/06)*

Physics Grades 11 - 12

Unit Name and Synopsis	Projected # of Days	Actual # of Days	Factors that Affected the Pace of Learning	Implications for Curriculum and Unit Design
Kinematics: Essential Understanding#1: Unit: Linear Motion	3 weeks	.	.	
Kinematics: Essential Understanding #2: Unit: Vectors	2 weeks			
Kinematics: Essential Understanding #3: Unit: Motion in Two-dimensions (Projectile Motion)	3 weeks			
Dynamics: Essential Understanding #4: Unit: Newton's Laws	3 weeks			
Dynamics: Essential Understanding #5: Unit: Motion in Two-dimensions (Circular Motion)	2 weeks			
Dynamics: Essential Understanding #6: Unit: Gravitation	3 weeks			
			Factors that	

Unit Name and Synopsis	Projected # of Days	Actual # of Days	Affected the Pace of Learning	Implications for Curriculum and Unit Design
Conservation of Energy and Momentum : Essential Understanding #7: Unit: Mechanical Energy and Work and Unit: Thermal Energy	5 weeks			
Conservation of Energy and Momentum : Essential Understanding #8: Unit: Impulse and Momentum	5 weeks			
Wave Production and Transmission : Essential Understanding #9: Unit: Waves and Sound	5 weeks			
Wave Production and Transmission : Essential Understanding #10: Unit: Light and Color, Unit: Quantum Theory, Unit :Optics	5 weeks			