PHYSICS

COURSE OUTLINE		
Unit One	*Motion in One Dimension*	*15 days*
Unit Two	*Two-Dimensional Motion & Vectors*	*15 days*
Unit Three	*Forces and the Laws of Motion*	*15 days*
Unit Four	*Work & Energy*	*15 days*
Unit Five	*Momentum & Collisions*	*15 days*
Unit Six	*Rotational Motion & Simple Machines*	*15 days*
Unit Seven	*Fluid Mechanics*	*10 days*
Unit Eight	*Heat & Thermodynamics*	*15 days*
Unit Nine	*Waves & Sound*	*15 days*
Unit Ten	*Light*	*15 days*
Unit Eleven	*Electric Forces, Fields & Energy*	*15 days*
Unit Twelve	*Currents, Circuits & Magnetism*	*15 days*

School-wide Academic Expectations Addressed in Physics:

- Problem Solving
- Collaboration

School-wide Social and Civic Expectations Addressed in Physics:

- Honesty
- Responsibility
- Respect
- Safety

Common Core Standards Addressed in Physics:

- *Reading Standard for Science Literacy (RST):* 2, 3, 4, 7, 8, 9
- *Writing Standards for Science Literacy (WHST):* 1, 2, 4, 9

NGSS Standards Addressed in Physics:

- *TBD*

Unit 1: Motion in One Dimension

Introduction: Physics can be used to explain anything in the physical world - from why we move back when the car moves forward to rockets move through space. The principles of physics can be used to predict how an object will move under various conditions. This unit focuses on motion in one dimension (straight line).

CT State Standard(s):
Enrichment Content Standards: Motion & Forces and Conservation of Energy & Momentum

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What is the relationship between displacement, time, speed and velocity?
- How are acceleration motion and non-accelerated motion different?
- How can acceleration be determined mathematically?
- Why is a freely falling body an example of motion with constant acceleration?

Key Terms/Concepts:
Acceleration, average velocity, displacement, frame of reference, free-fall, instantaneous velocity, magnitude.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
	1. Review Units of Measurement. 2. Compare and contrast accuracy and precision. 3. Carryout calculations using significant figure rules.	• Notes & Class Discussion • Demonstration of mathematic problem solving procedure • Cooperative Learning - Practice Problems .	Performance Task
Motion and Forces	4. Distinguish between displacement, distance, velocity, speed, and acceleration. 5. Solve problems involving displacement, distance, velocity, speed and constant acceleration	• Notes & Class Discussion • YouTube video clip • Demonstration of mathematic problem solving procedure • Cooperative Learning - Practice Problems	Performance Task
Motion and Forces	6. Create and interpret graphs of 1-dimensional motion, such as position vs. time, distance vs. time, speed vs. time and acceleration vs. time.	• Lab - Speed Challenge (T. Trimpe 2001) • Graphing Activity - Acceleration of a Falling Body (ECSU)	Performance Task Embedded Task

Motion and Forces	7. Describe how free-fall is actually acceleration. 8. Determine time, position and velocity of object in free-fall. 9. Defend conclusions using mathematical processes. 10. Apply concepts of free-fall to design and build container to protect object in free-fall	• Notes & Class Discussion • Lab - Acceleration of Object in free-fall • Cooperative Learning - Practice Problems • STEM Activity - Egg Drop Contest	Performance Task Embedded Task Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board

Unit 2: Two-Dimensional Motion & Vectors

Introduction: Many objects do not travel along a straight line. This unit explores the methods of describing this type of multi-dimensional motion. Using vectors and the Pythagorean Theorem along with other trigonometric functions, one can determine relative motion, and exploring projectile motion, neglecting air resistance.

CT State Standard(s):
Enrichment Content Standards: Motion & Forces and Conservation of Energy & Momentum

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What is a vector and how can it be used to predict motion?
- How does one predict the location, velocity or acceleration of a moving object?
- How does the angle at which an object is fired affect its path?

Key Terms/Concepts:
Projectile motion, resultant, scalar, vector

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
Motion and Forces	1. Compare and contrast vector quantities and scalar quantities	• Notes & Class Discussion	
Motion and Forces	2. Use the Pythagorean theorem and trigonometric functions to find resultant vectors and vector components	• Cooperative Learning - Practice Problems	Performance Task Quiz
Motion and Forces	3. Explore projectile motion, neglecting air resistance.	• PHET Lab - Projectile Motion	Embedded Task
Motion and Forces	4. Describe relative motion in terms of vector operations.	• Notes & Class Discussion	Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board**.**

Unit 3: Forces and the Laws of Motion

Introduction: This unit defines force and introduced free-body diagrams. It explores Newton's first law and the relationship between mass and inertia. The relationships between mass, acceleration, friction and the effect of action-reaction pairs are also explored.

CT State Standard(s):
Enrichment Content Standards: Motion & Forces and Conservation of Energy & Momentum

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What is a free-body diagram and how is it used?
- What is the relationship between mass and inertia?
- What are some everyday forces and how to they impact our lives?

Key Terms/Concepts:
Action-reaction pair, coefficient of friction, contact forces, equilibrium, force, friction, weight.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
Motion & Forces	1. Define force and introduce free-body diagrams	• Notes & Class Discussion	
Motion & Forces	2. Describe Newton's first law of motion and the relationship between mass and inertia.	• Notes & Class Discussion • Demonstration - Newton's 1st Law	
Conservation of Energy & Momentum	3. Introduce the relationship between net external force, mass and acceleration. 4. Mathematically determine the net external force of an object.	• Cooperative Learning - Practice Problems	Performance Task
Conservation of Energy & Momentum	5. Describe the acceleration of an object in terms of the mass and force acting on it.	• Notes & Class Discussion	
Motion & Forces	6. Predict the direction and magnitude of the acceleration caused by a known external force	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Conservation of Energy & Momentum	7. Describe and identify action-reaction pairs.	• Notes & Class Discussion • Lab - Newton's Laws of Motion	Embedded Task
Conservation of Energy & Momentum	8. Compare and contrast weight and mass.	• Class Discussion	
Conservation of Energy & Momentum	9. Determine the direction and magnitude of a force.	• Cooperative Learning - Practice Problems	Performance Task
Motion & Forces	10. Describe forms of friction, calculate frictional forces.	• Notes & Class Discussion • PHET Lab - Friction Simulation • Cooperative Learning - Practice Problems	Embedded Task Performance Task Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board

Unit 4: Work & Energy

Introduction: Work and the different types of energy that are relevant to mechanic are explored in this unit. The conditions necessary for conservation of mechanical energy are investigated and the relationships between work, time, power, force and speed are introduced.

CT State Standard(s):
Enrichment Content Standards: Motion & Forces and Conservation of Energy & Momentum

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What is work and how is it calculated in a variety of situations?
- How does energy transform?
- What conditions are necessary for mechanical energy to be conserved?
- What is the relationship between work, time, power, force and speed?

Key Terms/Concepts:
Elastic potential energy, gravitational potential energy, kinetic energy, mechanical energy, potential energy, power, spring constant, work.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
Motion & Forces Conservation of Energy & Momentum	1. Describe work and show calculations of the work done in a variety of situations.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Conservation of Energy & Momentum	2. Identify several forms of energy. 3. Compare & contrast kinetic and potential energy. 4. Calculate the kinetic/potential energy of an object.	• Notes & Class Discussion • Cooperative Learning - Practice Problems • Lab - Determine Spring Constant of a Toy	Performance Task Embedded Task
Conservation of Energy & Momentum	5. Describe conditions necessary for conservation of mechanical energy and apply principles to problem solving.	• Notes & Class Discussion • Cooperative Learning - Practice Problems • Lab - Hooke's Law Apparatus or Lab 6 - Changes in Potential Energy	Performance Task Embedded Task
Conservation of Energy & Momentum	6. Describe the relationship between energy, time and power. 7. Apply principles to problem solving.	• Notes & Class Discussion • Cooperative Learning - Practice Problems • Lab - Comparing Kinetic Energy & Potential Energy • Lab 3 - Work, Energy & Power Essentials of Physics: PHY 101	Performance Task Embedded Task
	8. Explain the effect of machines on work and power.	• Class Discussion • Cooperative Learning - Practice Problems	Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board

Unit 5: Momentum & Collisions

Introduction: Many everyday situations use concepts of momentum and collisions - the game of soccer, riding in a car, jumping on a trampoline. This unit defines momentum in terms of velocity and impulse. It investigates the law of conservation of momentum and uses this law to predict the motion of an object after an elastic/inelastic collision**.**

CT State Standard(s):
Enrichment Content Standards: Conservation of Energy & Momentum

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What is momentum and how does it relate to velocity and impulse?
- How is the final velocity of an object after a collision predicted?
- What are some different types of collisions?

Key Terms/Concepts:
Elastic collision, impulse, momentum, perfectly inelastic collision.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
Conservation of Energy & Momentum	1. Compare & contrast the momentum of different moving objects. 2. Compare the momentum of the same object moving with different velocities.	• Demonstration • Class Discussion • PHET Lab - Momentum and Simple 1D Collision • Cooperative Learning - Practice Problems	Performance Task Embedded Task
Conservation of Energy & Momentum	3. Identify examples of change in the momentum of an object and describe changes in terms of force and time.	• Notes & Class Discussion	Oral Responses

Conservation of Energy & Momentum	4. Describe and prove mathematically how momentum is conserved.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Conservation of Energy & Momentum	5. Identify different types of collisions. Determine the changes in kinetic energy.	• Demonstration • Notes & Class Discussion • Cooperative Learning - Practice Problems • Lab - Marble Madness II	Performance Task Embedded Task
Conservation of Energy & Momentum	6. Calculate the final velocity of an object on various collision situations.	• Cooperative Learning - Practice Problems	Performance Task Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board

Unit 6: Rotational Motion & Simple Machines

Introduction: Laundry rotating in a washing machine, riding spinning amusement-park rides, racing a car around a track all depends on a fine balance between forces to maintain the circular motion. This unit introduces the causes of circular motion, including gravity and the formulas and units for angular displacement, angular speed and angular acceleration. Other topics explored are torque and Newton's second law for rotation. The unit culminates with the investigation and application of conservation of energy, including mechanical advantage and efficiency in simple machines.

CT State Standard(s):
Enrichment Content Standards: Motion & Forces and Conservation of Energy & Momentum

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What causes circular or rotational motion?
- How speed, acceleration and displacement of a rotating object determined?
- What is torque and how does it impact the rotation of an object?
- What simple machines and how do they work?

Key Terms/Concepts:

Angular acceleration, angular displacement, angular speed, center of mass, centripetal acceleration, mechanical advantage, moment of inertia, radian, rotational motion, tangential acceleration, tangential speed, torque.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
	1. Relate radians to degrees.	• Notes & Class Discussion	
Motion & Forces	2. Explore variable that affect and maintain motion of a rotating object.	• Class Discussion • Lab - Centripetal Force	Embedded Assessment
Motion & Forces	3. Calculate angular displacement using arc length and distance from axis of rotation.	• Cooperative Learning - Practice Problems	Performance Task
Motion & Forces	4. Calculate angular speed or acceleration.	• Cooperative Learning - Practice Problems	Performance Task
Motion & Forces	5. Solve problems involving tangential acceleration and centripetal acceleration.	• Cooperative Learning - Practice Problems	Performance Task
Motion & Forces	6. Calculate the force that maintains circular motion.	• Cooperative Learning - Practice Problems • PHET Lab - Torque	Performance Task Embedded Task
Motion & Forces	7. Apply Newton's universal law of gravitation between two objects.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Oral Responses Performance Task
Motion & Forces	8. Distinguish between torque and force. Calculate the magnitude of a torque on an object.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Motion & Forces	9. Describe center of mass and moment of inertia and their effect on rotational motion.	• Notes & Class Discussion	Oral Responses
Motion & Forces	10. Apply Newton's law for rotational motion to solve problems involving rotational kinetic energy.	• Cooperative Learning - Practice Problems	Performance Task
Motion & Forces	11. Compare and contrast the various forms of simple machines and calculate the mechanical advantage of each.	• Notes & Class Discussion • Lab - Simple Machines Exploration • Cooperative Learning - Practice Problems	Embedded Task Summative Assessment - Test Summative Assessment - Mid-Term Exam

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board

Unit 7: Fluid Mechanics

Introduction: During World War II, with a shortage of metal, cement was used to make ships - how is this possible? This unit examines the relationship between fluids (gases and liquids) and buoyant force. It also explores the motion of fluids and applies Bernoulli's equation to solve fluid flow problems. Finally, the properties of an ideal gas are predicted under various conditions.

CT State Standard(s):
Enrichment Content Standards: Conservation of Energy & Momentum and Heat & Thermodynamics

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- Why do objects float or sink?
- How do fluids exert pressure and how does the pressure change with depth?
- What are Pascal's and Bernoulli's Principle and how does each work?
- Why gases are considered fluids?

Key Terms/Concepts:
Buoyant force, fluid, Bernoulli's Principle, ideal fluid, mass density, pressure, temperature.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
	1. Review definition of a fluid. Compare & contrast matter is liquid and gas states.	• Notes & Class Discussion	
Motion & Forces	2. Mathematically determine the magnitude of buoyant force on a floating or submerged object.	• Cooperative Learning - Practice Problems	Performance Task
Motion & Forces	3. Describe conditions that cause objects to float or sink.	• Notes & Class Discussion • PHET Lab - Buoyancy Lab	Embedded Assessment
Conservation of Energy & Momentum	4. Describe effect of depth on pressure. 5. Calculate the pressure exerted by a fluid.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Heat & Thermodynamics	6. Describe fluids in terms of temperature	• Notes & Class Discussion	

Conservation of Energy & Momentum	7. Describe the principles of fluid flow and factors affecting flow rate.	• Notes & Class Discussion	Oral Responses
	8. Define general properties of an ideal gas. 9. Used ideal gas law to predict properties of an ideal gas under various conditions.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board

Unit 8: Heat & Thermodynamics

Introduction: This unit investigates what distinguishes temperature and heat and how different substances behave when energy is added/removed from them, causing a change in temperature or phase. In addition, how work and heat serve to change a system's internal energy and how machine efficiency is limited, are also examined.

CT State Standard(s):
Enrichment Content Standards: Heat & Thermodynamics

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What is heat and how does it move?
- How are changes in temperature and phases related?
- What is the relationship between heat and work?
- What is a heat engine and how does it work?
- Large or small scale, how is a system changing?

Key Terms/Concepts:
Adiabatic process, calorimeter, conduction, convection, cyclic process, entropy, heat, heat of fusion, heat of vaporization, internal temperature, isothermal process, isovolumetric process, latent heat, radiation, specific heat.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
Heat & Thermodynamics	1. Review various temperature scales. 2. Convert from one scale to another.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Heat & Thermodynamics	3. Relate temperature to the kinetic energy of atoms and molecules.	• Notes & Class Discussion	
Heat & Thermodynamics	4. Describe the changes in the temperature of two objects reaching thermal equilibrium.	• Notes & Class Discussion • Lab - #10 Temperature and Internal Energy	Embedded Assessment
Heat & Thermodynamics	5. Explain heat as the energy transferred between two substances at different temperatures.	• Class Discussion	
Heat & Thermodynamics	6. Apply the principles of energy conservation to calculate changes in potential, kinetic and internal energy.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Heat & Thermodynamics	7. Perform calculations with specific heat capacity and latent heat.	• Cooperative Learning - Practice Problems: Introduction to Specific Heat Capacities	Performance Task
Heat & Thermodynamics	8. Interpret phase change diagrams	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Heat & Thermodynamics	9. Describe a system as it moves heat energy in order to do work	• Class Discussion • Activity - Entropy Game	Oral Responses Performance Task
Heat & Thermodynamics	10. Mathematically determine the amount of work done during a thermodynamic process.	• Cooperative Learning - Practice Problems	Performance Task
Heat & Thermodynamics	11. Compare and contrast isovolumetric, isothermal and adiabatic thermodynamic processes.	• Notes & Class Discussion	
Heat & Thermodynamics	12. Correlate the first law of thermodynamics and energy conservation.	• Notes & Class Discussion	Oral Responses
Heat & Thermodynamics	13. Apply the first law of thermodynamics to describe cyclic processes.	• Notes & Class Discussion	Oral Responses
Heat & Thermodynamics	14. Calculate heat, work and the change in energy apply the first law of thermodynamics.	• Cooperative Learning - Practice Problems	Performance Task
Heat & Thermodynamics	15. Explain the second law of thermodynamics.	• Notes & Class Discussion	Oral Responses
Heat & Thermodynamics	16. Describe a heat engine and calculate the efficiency.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Performance Task Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board

Unit 9: Waves & Sound

Introduction: The swing of a clock pendulum is an example of a periodic motion known as simple harmonic motion. This unit begins with simple harmonic motion and general wave motion. The unit then shifts focus to sound waves - exploring how sound waves are produced, characteristics of sound waves, and introduces the Doppler Effect. Practical applications of sound wave theory and the basics of musical sound are also investigated.

CT State Standard(s):
Enrichment Content Standards: Waves

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- How are transverse and compressional waves similar and different?
- What are everyday examples of objects in simple harmonic motion?
- How are sound waves produced and interpreted?
- How animals used inaudible sounds?
- How are intensity, decibel level and perceived loudness related?
- How do various musical instruments use physics?

Key Terms/Concepts:
Amplitude, antinode, compression, Doppler effect, frequency, harmonic series, Hooke's Law, interference, medium, period, rarefaction, resonance, standing wave, timbre, wavelength

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
Waves	1. Describe conditions of simple harmonic motion.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Oral Responses Performance Task
Waves	2. Explain how force, velocity, & acceleration change as an object vibrates with simple harmonic motion.	• Notes & Class Discussion • Demonstration - Simple Harmonic Motion	

Waves	3. Identify the amplitude of vibration. 4. Describe relationships between period and frequency.	• Class Discussion • Lab - Simple Pendulum Physical Science 101	Performance Task
Waves	5. Calculate the spring force using Hooke's Law.	• PHET Lab - Pendulums & Spring Waves • Practice Problems	Embedded Task
Waves	6. Calculate the period and frequency of an object with simple harmonic motion.	• Cooperative Learning - Practice Problems	Performance Task
Waves	7. Describe motion of local particle vibration to overall wave motion.	• Class Discussion	
Waves	8. Compare & contrast pulse waves, periodic waves, transverse and longitudinal waves.	• Notes & Class Discussion	
Waves	9. Apply mathematics to describe relationship among wave speed, frequency, and wavelength.	• Cooperative Learning - Practice Problems	Performance Task
Waves	10. Compare & contrast constructive and destructive interference. 11. Predict the resultant wave given various wave patterns.	• Class Discussion • Practice Problems • PHET Lab - Wave Interference	Performance Task
	12. Describe how sound waves are produced.	• Notes & Class Discussion	Oral Responses
Waves	13. Describe factors affecting the production and modification of sound.	• Notes & Class Discussion	Oral Responses
Waves	14. Calculate the speed of sound in various media.	• Cooperative Learning - Practice Problems	Performance Task
Waves	15. Describe the Doppler Effect and determine changes in sound relative to motion.	• Class Discussion • Activity - Doppler Ball	Embedded Task
	16. Describe intensity, decibel level, and perceived loudness; Calculate the intensity of sound waves.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Performance Task
	17. Define resonance and describe application and implications of resonance control.	• Class Discussion • You Tube Clip - Bridge Resonance	Oral Responses
Waves	18. Compare & contrast the harmonic series of open and closed pipes. 19. Calculate the harmonics of a vibrating string and open/closed pipes.	• Notes & Class Discussion • Cooperative Learning - Practice Problems	Performance Task Summative Assessment - Test
	20. Apply concepts of sound production and harmonics in the production and performance of a musical instrument	• STEM Activity - Build & Play Musical Instrument	Embedded Assessment

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002

Suggested Technology: Computer w/ interactive white board

Unit 10: Light

Introduction: Both visible light and sound travel in waves. This unit focuses on forms of electromagnetic radiation, specifically light and its behavior during reflection, refraction, diffraction and interference. Practical applications of light theory and lasers are also explored.

CT State Standard(s):
Enrichment Content Standards: Waves

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What is light and what are its properties?
- How do mirrors affect light?
- How do lenses affect light?
- What is color and how does color from light compare to color from pigments?

Key Terms/Concepts: Angle of incidence, angle of reflection, concave, convex, critical angle, focal point, lasers, lens, polarization, refraction, virtual image.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
Waves	1. Review components of the electromagnetic spectrum.	• Class Discussion	Oral Responses
Waves	2. Describe light and its properties in terms of wave and particle theories.	• Class Discussion	
Waves	3. Calculate the frequency or wavelength of electromagnetic radiation.	• Cooperative Learning - Practice Problems	Performance Task
	4. Compare & contrast specular and diffuse reflection of light.	• Demonstration • Class Discussion	Oral Responses
Waves	5. Apply the law of reflection for flat mirrors.	• Class Discussion • Mini Lab - 15.3 Mirror Mirror	Embedded Task

	6. Experimentally determine the nature and location of images formed by flat and curved mirrors.	• Class Discussion • Lab - 15.4 Images with Mirrors • Lab - 15.5 Finding the Points with Mirrors	Embedded Task
Waves	7. Experimentally and mathematically calculate distances and focal length using the lens equation for concave & convex lens.	• Class Discussion • Lab - 15.8 Images with Lenses • Lab - 15.9 Finding the Point with Lenses	Embedded Task
	8. Draw ray diagrams to find image distance and magnification for concave and convex mirrors.	• Class Discussion • You Tube Video - Drawing Ray Diagrams • Cooperative Learning - Practice Problems	Performance Task
	9. Explore how additive colors affect the color of light and how pigments affect reflected light.	• Class Discussion • Lab - 15.14 Color Me Confused	Embedded Task
	10. Describe polarization and its application in industry.	• Class Discussion • Demonstration - Polarization	Oral Responses
Waves	11. Describe refraction of light and determine direction light will bend when it passes from one medium to another.	• Class Discussion • Lab - Refraction Gel Lab • Research Activity - Index of Refraction	Embedded Task Performance Task
Waves	12. Solve problems mathematically and experimentally using Snell's Law.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Waves	13. Describe phenomena such as rainbows, mirages and internal reflection in terms of index of refraction and wavelength.	• Class Discussion	
Waves	14. Identify the conditions required for interference and refraction to occur and how light will be altered.	• Class Discussion	Oral Responses
	15. Describe the properties of laser light and explain how laser light has particular advantages in various applications.	• Class Discussion • Demonstration - Lasers	Oral Responses Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002, Teaching Physics for the First Time - Mader & Winn (2012)

Suggested Technology: Computer w/ interactive white board

Unit 11: Electric Forces, Fields & Energy

Introduction: This unit examines electric force and how this force is used to do work. It examines Coulomb's law and introduces electric field and the properties of conductors. Electric potential energy as a form of mechanical energy and its relationship to capacitance is also explored.

CT State Standard(s):
Enrichment Content Standards: Electric & Magnetic Phenomena

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What are the properties of electric charges and how are they transferred?
- How is an electric force measure, calculated and drawn?
- How is an electric field generated?
- What is the relationship between electric potential and the electric field?
- What is voltage and how is it determined?
- How can electricity be used to do work?

Key Terms/Concepts:
Capacitance, conductor, electric field, electric potential, induction, insulator, voltage.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
	Describe the basic properties of electric charge.	• Class Discussion	
Electric & Magnetic Phenomena	Explore how Millikan determined the charge or mass of an electron.	• Class Discussion • Virtual Chem Lab Program	Performance Task
Electric & Magnetic Phenomena	Calculate the electric force exerted between two particles using Coulomb's Law. Compare electric force with gravitational force	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task Quiz
	Determine the magnitude of and direction of the electric force.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task Quiz

Electric & Magnetic Phenomena	Draw & interpret electric field lines.	• Class Discussion • You Tube Video - Drawing Electric Field Lines • Cooperative Learning - Practice Problems	Performance Task QUIZ - Coulomb's Law & Electric Fields
Electric & Magnetic Phenomena	Define and calculate electrical potential energy for various charge distributions.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
	Explore factors that influence capacitance	• PHET Lab - Capacitor Lab	
Electric & Magnetic Phenomena	Calculate the capacitance of various devices and the energy stored in a capacitor.	• Cooperative Learning - Practice Problems	Performance Task Summative Assessment - Test

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002,

Suggested Technology: Computer w/ interactive white board, Virtual ChemLab (Pearson/Prentice Hall) ISBN# 0-13-166412-3

Unit 12: Currents, Circuits & Magnetism

Introduction: Tesla versus Edison...In this unit, the movement of electric charge will be studied, as well as, the factors affecting the flow of charge through different material. Students will be able to interpret, draw and built electrical circuits. Magnets can also impact the production of an electric current. This unit will also explore electromagnetism and the applications of magnetic fields.

CT State Standard(s):
Enrichment Content Standards: Electric & Magnetic Phenomena

Common Core Standard(s):
- Reading Standard for Science Literacy (RST): 2, 3, 4, 7, 8, 9
- Writing Standards for Science Literacy (WHST): 1, 2, 4, 9

Essential Question(s):
- What are the basic properties of electric current?
- Compare and contrast direct and alternating current.
- What are the different types of circuits and how do they work?
- What is Ohm's law and how is it applied?
- What is a magnetic field and how does an electromagnet work?

Key Terms/Concepts:

Electric circuit, emf, parallel, schematic drawing, series.

LEARNING PLAN

STANDARD	LEARNING OBJECTIVES (Content and Skill)	INSTRUCTIONAL STRATEGIES	ASSESSMENT EVIDENCE
	Describe the basic properties of electrical currents.	• Class Discussion • Cooperative Learning - Practice Problems	
Electric & Magnetic Phenomena	Solve problems relating current, charge, and time.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Electric & Magnetic Phenomena	Calculate resistance, current, and potential difference using Ohm's Law.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Electric & Magnetic Phenomena	Identify factors that affect resistance and how resistance is used in industry. Describe unique features of superconductors.	• Class Discussion • Cooperative Learning - Practice Problems	
Electric & Magnetic Phenomena	Review how electric energy is converted to other forms of energy. Calculate electric power and the cost of running electrical appliances.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Electric & Magnetic Phenomena	Interpret and construct circuit drawing. Build various circuits.	• Class Discussion • Draw circuits using given schematic symbols • Lab - Building Circuits	Performance Task Embedded Task Quiz - Circuits
Electric & Magnetic Phenomena	Determine the potential difference across the circuit load	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
	Predict whether magnets will repel or attract given various situations.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
	Describe the magnetic field around a permanent magnet. Describe the orientation of the Earth's magnetic field.	• Class Discussion	Oral Responses
Electric & Magnetic Phenomena	Given the force on a charge, mathematically determine the strength of the magnetic field.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Electric & Magnetic Phenomena	Determine the magnitude and direction of the force on a wire carrying a current in a magnetic field.	• Class Discussion • Cooperative Learning - Practice Problems	Performance Task
Electric & Magnetic Phenomena	Build an electromagnetic and explore its properties.	• Class Discussion • Lab - Build Electromagnet • PHET Lab - Faraday's Electromagnetic Lab	Embedded Task Quiz - Magnetism
Electric & Magnetic Phenomena	Define induction and describe applications.	• Class Discussion	

Electric & Magnetic Phenomena	Compare and contrast alternating and direct current.	• Class Discussion • You Tube Video - AC vs DC • PHET Lab - Faraday's Electromagnetic Lab Part 2	Oral Responses Embedded Task

Suggested Resources and Texts: Holt Physics - Serway & Faughn, 2002,

Suggested Technology: Computer w/ interactive white board