Physics

	Chapter	HSCE's	Vocabulary	Pacing
Unit 1: Motion	Chapter 1 : About Science	**P1.1A** Generate new questions that can be investigated in the laboratory or field. **P1.1B** Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions. **P1.1C** Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity–length, volume, weight, time interval temperature–with the appropriate level of precision). **P1.1D** Identify patterns in data and relate them to theoretical models. **P1.1E** Describe a reason for a given conclusion using evidence from an investigation. **P1.1f** Predict what would happen if the variables, methods, or timing of an investigation were changed. **P1.1g** Based on empirical evidence, explain and critique the reasoning used to draw a scientific conclusion or explanation. **P1.1h** Design and conduct a systematic scientific investigation that tests a hypothesis. Draw conclusions from data presented in charts or tables. **P1.1i** Distinguish between scientific explanations that are regarded as current scientific consensus and the emerging questions that active researchers investigate. **P1.2A** Critique whether or not specific question scan be answered through scientific investigations. **Assessment: Chapter Test, Poster Project, Quizzes, Worksheets**	Fact Hypothesis Law Principle Scientific Method Theory	3 Days

	Chapters	HSCE's	Vocabulary	Pacing
Unit 1: Motion	Chapter 2: Linear Motion Chapter 3: Projectile Motion	**P2.1A** - Calculate the average speed of an object using the change of position and elapsed time. **P2.1B** - Represent the velocities for linear and circular motion using motion diagrams (arrows on strobe pictures). **P2.1C** - Create line graphs using measured values of position and elapsed time. **P2.1D** - Describe and analyze the motion that a position-time graph represents, given the graph. **P2.1g** - Solve problems involving average speed and constant acceleration in one dimension. **P2.2A** - Distinguish between the variables of distance, displacement, speed, velocity, and acceleration. **P2.2B** - Use the change of speed and elapsed time to calculate the average acceleration for linear motion. **P2.2C** - Describe and analyze the motion that a velocity-time graph represents, given the graph. **P2.2e** - Use the area under a velocity-time graph to calculate the distance traveled and the slope to calculate the acceleration **P2.3a** - Describe and compare the motion of an object using different reference frames. **P2.2** Velocity-Time **P3.4** Forces and Acceleration **P3.2** Net Forces Content Expectations: (Content Statement Clarification) **P2.2g**– Apply the independence of the vertical and horizontal initial velocities to solve projectile motion problems. **P3.4e** – Solve problems involving force, mass and acceleration in two dimensional projectile motions restricted to an initial horizontal velocity with no initial vertical velocity (e.g., a ball rolling off a table). **P3.2d** – Calculate all the forces on an object on an inclined plane and describe the object's motion based on the forces using free-body diagrams. **Assessments: Chapter Tests, Quizzes, Worksheets, Labs**	Acceleration Average Speed Circular Motion Constant Acceleration Displacement Frame of Reference Function Graph Linear Motion Motion Motion diagram Position Relative Motion Scalar Speed Time Vector Velocity Position Velocity Average speed Average acceleration Vertical velocity Horizontal velocity Projectile motion Projectile Acceleration due to gravity Proportional Net Force Inversely proportional Mass Two-dimensional projectile motion Inclined plane Free-body diagrams	8 Days

Chapters		HSCE's	Vocabulary	Pacing
Unit 2: Dynamics	Chapter 4: Newton's First Law; Inertia Chapter 5: Newton's Second Law; Force and Acceleration Chapter 6: Newton's Third Law; Action and Reaction	**P3.1A** - Identify the force(s) acting between objects in "direct contact" or at a distance. **P3.1d** - Identify the basic forces in everyday interactions. **P3.2A** - Identify the magnitude and direction of everyday forces (e.g., wind, tension in ropes, pushes and pulls, weight). **P3.2C** - Calculate the net force acting on an object. Clarification: None. **P3.3A** - Identify the action and reaction force from examples of forces in everyday situations (e.g., book on a table, walking across the floor, pushing open a door). **P3.4A** - Predict the change in motion of an object acted on by several forces. **P3.4B** - Identify forces acting on objects moving with constant velocity (e.g., cars on a highway). **P3.4C** - Solve problems involving force, mass, and acceleration in linear motion (Newton's second law). **P3.6C** - Explain how your weight on Earth could be different from your weight on another planet.	Acceleration Action/Reaction Forces Atoms Contact forces Direction of a force Electric Force Electromagnetic Force Equal & Opposite Force Force Friction Gravitational Force Inverse square law Inversely proportional Linear motion Magnitude of a force Mass Molecules Net force Newton's First Law Newton's Second Law Newton's Third Law Proportional Scalar Speed Strong nuclear force Tension Vector Velocity Weight	24 Days
		Assessments: Chapter Test, Quizzes, Worksheets, Labs, Paper Airplane Project		

Chapter		HSCE's	Vocabulary	Pacing
Unit 3: Momentum	Chapter 7: Momentum	**P3.4f** - Calculate the changes in velocity of a thrown or hit object during and after the time it is acted on by the force. **P3.4g**- Explain how the time of impact can affect the net force (e.g., air bags in cars, catching a ball). **P3.5a** - Apply conservation of momentum to solve simple collision problems. **P3.3b** - Predict how the change in velocity of a small mass compares to the change in velocity of a large mass when the objects interact (e.g., collide). **P3.3c** - Explain the recoil of a projectile launcher in terms of forces and masses. **P3.3d** - Analyze why seat belts may be more important in autos than in buses.	Acceleration Average velocity Change in velocity Collision Fnet=ma Inversely proportional Law of Conservation of Momentum Mass Momentum Net Force Newton's Second Law Newton's Third Law Projectile Proportional Vector Velocity	8 Days
		Assessments: Chapter Tests, Quizzes, Worksheets, Egg Drop Project		

	Chapters	HSCE's	Vocabulary	Pacing
Unit 4: Periodic Motion	Chapter 9: Circular Motion Chapter 10: Center of Gravity	**P2.1E** - Describe and classify various motions in a plane as one dimensional, two dimensional, circular, or periodic. **P2.1F -** Distinguish between rotation and revolution and describe and contrast the two speeds of an object like the Earth. **P2.1h** - Identify the changes in speed and direction in everyday examples of circular (rotation and revolution), periodic, and projectile motions. **P2.2D** - State that uniform circular motion involves acceleration without a change in speed. **P2.2f** - Describe the relationship between changes in position, velocity, and acceleration during periodic motion. **P3.4D** - Identify the force(s) acting on objects moving with uniform circular motion (e.g., a car on a circular track, satellites in orbit). **P3.6A** - Explain earth-moon interactions (orbital motion) in terms of forces. **P3.6B** - Predict how the gravitational force between objects changes when the distance between them changes. **P3.6d** - Calculate force, masses, or distance, given any three of these quantities, by applying the Law of Universal Gravitation, given the value of G. **P3.6e** - Draw arrows (vectors) to represent how the direction and magnitude of a force changes on an object in an elliptical orbit.	Axis Center of Gravity Center of Mass Centrifugal Force Centripetal Force Linear Speed Neutral Equilibrium Revolution Rotation Rotational Speed Stable Equilibrium Tangential Speed Unstable Equilibrium	14 Days
		Assessments: Chapter Tests, Quizzes, Worksheets, Labs		

Chapter		HSCE's	Vocabulary	Pacing
Unit 5: Energy	Chapter 8: Energy	**P3.2A** - Compare work done in different situations. **P4.1c** - Explain why work has a more precise scientific meaning than the meaning of work in everyday language. **P4.1d** - Calculate the amount of work done on an object that is moved from one position to another. **P4.1e** - Using the formula for work, derive a formula for change in potential energy of an object lifted a distance h. **P4.3A** - Identify the form of energy in given situations (e.g., moving objects, stretched springs, rocks on cliffs, energy in food). **P4.3B** - Describe the transformation between potential and kinetic energy in simple mechanical systems (e.g., pendulums, roller coasters, ski lifts). **P4.3C** - Explain why all mechanical systems require an external energy source to maintain their motion. Clarification: None. **P4.3d** - Rank the amount of kinetic energy from highest to lowest of everyday examples of moving objects. **P4.3e** - Calculate the changes in kinetic and potential energy in simple mechanical systems (e.g., pendulums, roller coasters, ski lifts) using the formulas for kinetic energy and potential energy. **P4.3f** - Calculate the impact speed (ignoring air resistance) of an object dropped from a specific height or the maximum height reached by an object (ignoring air resistance), given the initial vertical velocity. **Assessments: Chapter Tests, Quizzes, Worksheets, Labs**	DPE=mgDh Air Resistance Change in Direction Change in Speed Direction of a Force Drag Energy Energy Transfer Force Gravitational Energy Gravitational Potential Energy Impact Speed KE= ½mv2 Kinetic Energy Magnitude of a Force Mechanical Systems Net Force Newton's First Law Newtonian Mechanics Pendulum Potential Energy Speed Velocity W=Fd Waves Work	8 Days

Chapter		HSCE's	Vocabulary	Pacing
Unit 6: Mechanical Waves	Chapter 25: Vibrations and Waves	**P4.4A** - Describe specific mechanical waves (e.g., on a demonstration spring, on the ocean) in terms of wavelength, amplitude, frequency, and speed. **P4.4B** - Identify everyday examples of transverse and compression (longitudinal) waves. **P4.4C** - Compare and contrast transverse and compression (longitudinal) waves in terms of wavelength, amplitude, and frequency. **P4.4d** - Demonstrate that frequency and wavelength of a wave are inversely proportional in a given medium. **P4.4e** - Calculate the amount of energy transferred by transverse or compression waves of different amplitudes and frequencies (e.g., seismic waves). **P4.5A** - Identify everyday examples of energy transfer by waves and their sources. **P4.5B** - Explain why an object (e.g., fishing bobber) does not move forward as a wave passes under it. **P4.5C** - Provide evidence to support the claim that sound is energy transferred by a wave, not energy transferred by particles. **P4.5D** - Explain how waves propagate from vibrating sources and why the intensity decreases with the square of the distance from a point source. **P4.5E** - Explain why everyone in a classroom can hear one person speaking, but why an amplification system is often used in the rear of a large concert auditorium. **P4.8c** - Describe how two wave pulses propagated from opposite ends of a demonstration spring interact as they meet. **P4.8d** – List and analyze everyday examples that demonstrate the interference characteristics of waves (e.g., dead spots in an auditorium, whispering galleries, colors in a CD, beetle wings). **Assessments: Chapter Tests, Quizzes, Worksheets, Labs**	Compression (longitudinal) wave Demonstration spring Diffraction Electromagnetic wave Frequency Hertz Interference Inverse square law Inversely Proportional Mechanical wave Point source Proportional Refraction Seismic wave Sound wave Superimpose Transporting matter and/or energy Transverse wave Vibrations Water wave Wave amplitude Wave medium Wave propagation Wave pulse Wave source Wave speed Wave velocity Wavelength	12 Days

	Chapters	HSCE's	Vocabulary	Pacing
Unit 7: Electromagnetic Waves	Chapter 26: Sound Chapter 27: Light Chapter 28: Color Chapter 29:Reflection and Refraction	**P4.6A -** Identify the different regions on the electromagnetic spectrum and compare them in terms of wavelength, frequency, and energy. **P4.6B** - Explain why radio waves can travel through space, but sound waves cannot. **P4.6C** - Explain why there is a time delay between the time we send a radio message to astronauts on the moon and when they receive it. **P4.6D** - Explain why we see a distant event before we hear it (e.g., lightning before thunder, exploding fireworks before the boom). **P4.6e** - Explain why antennas are needed for radio, television, and cell phone transmission and reception. **P4.6f** - Explain how radio waves are modified to send information in radio and television programs, radio-control cars, cell phone conversations, and GPS systems. **P4.6g** - Explain how different electromagnetic signals (e.g., radio station broadcasts or cell phone conversations) can take place without interfering with each other. **P4.6h** - Explain the relationship between the frequency of an electromagnetic wave and its technological uses. **P4.8A** - Draw ray diagrams to indicate how light reflect off objects or refracts into transparent media. **P4.8B** - Predict the path of reflected light from flat, curved, or rough surfaces (e.g., flat and curved mirrors, painted walls, paper). **P4.8e** - Given an angle of incidence and indices of refraction of two materials, calculate the path of a light ray incident on the boundary (Snell's Law). **P4.8f** - Explain how Snell's Law is used to design lenses (e.g., eye glasses, microscopes, telescopes, binoculars). **P4.9A** - Identify the principle involved when you see a transparent object (e.g., straw, a piece of glass) in a clear liquid. **P4.9B** - Explain how various materials reflect, absorb, or transmit light in different ways. **P4.9C** - Explain why the image of the Sun appears reddish at sunrise and sunset. **Assessments: Chapter Tests, Quizzes, Worksheets, Labs**	Absorption Acceleration Analog Angle of incidence Angle of reflection Angle of refraction Antenna Charges Diffraction Digital Electric field Electromagnetic Wave Energy Frequency Incident wave Infrared waves Interference Law of Reflection Lens Magnetic field Microwaves Modulation Radio waves Ray diagram Reception Reflected wave Reflection Refracted wave Refraction Snell's Law Sound waves Speed of light Transmission Ultraviolet light Visible light Wavelength X-rays	32 Days

Chapters		HSCE's	Vocabulary	Pacing
Unit 8: Electric Forces and Current	Chapter 32: Electrostatics	**P3.1b** - Explain why scientists can ignore the gravitational force when measuring the net force between two electrons. **P3.1c** - Provide examples that illustrate the importance of the electric force in everyday life. **P3.7A** - Predict how the electric force between charged objects varies when the distance between them and/or the magnitude of charges change. **P3.7B** - Explain why acquiring a large excess static charge (e.g., pulling off a wool cap, touching a Van de Graff generator, combing) affects your hair. **P3.7c** - Draw the redistribution of electric charges on a neutral object when a charged object is brought near. **P3.7d** - Identify examples of induced static charges. **P3.7e** - Explain why an attractive force results from bringing a charged object near a neutral object. **P3.7f** - Determine the new electric force on charged objects after they touch and are then separated. **P3.7g** - Propose a mechanism based on electric forces to explain current flow in an electric circuit. **P3.8b** - Explain how the interaction of electric and magnetic forces is the basis for electric motors, generators, and the production of electromagnetic waves. **Assessments: Chapter Tests, Quizzes, Worksheets, Labs**	Charged object Conductor Contact forces Coulomb's Law Direction of a force Distribution of electric charge Electric charge Electric circuit Electric force Electric generator Electric motor Electric potential Electrical current Electrically neutral Electromagnetic force Electromagnetic wave Electron Force Forces at a distance Friction Gravitational force Induction Inverse square law Inversely proportional Like charge Magnet Magnetic force Magnitude of a force Magnitude of charge Moving electrical charge Moving magnet Net force Opposite charge Proportional Proton Repel/attract Static charge Van de Graff generator	8 Days

	Chapters	HSCE's	Vocabulary	Pacing
Unit 8: Electric Forces and Current	Chapter 33: Electric Fields and Potential Chapter 34: Electric Current	**P4.10A** - Describe the energy transformations when electrical energy is produced and transferred to homes and businesses. **P4.10B** - Identify common household devices that transform electrical energy to other forms of energy, and describe the type of energy transformation. **P4.10C** - Given diagrams of many different possible connections of electric circuit elements, identify complete circuits, open circuits, and short circuits and explain the reasons for the classification. **P4.10D** - Discriminate between voltage, resistance, and current as they apply to an electric circuit. **P4.10e** - Explain energy transfer in a circuit, using an electrical charge model. **P4.10f** - Calculate the amount of work done when a charge moves through a potential difference, V. **P4.10g** - Compare the currents, voltages, and power in parallel and series circuits. **P4.10h** - Explain how circuit breakers and fuses protect household appliances. **P4.10i** - Compare the energy used in one day by common household appliances (e.g., refrigerator, lamps, hair dryer, toaster, televisions, music players). **P4.10j** - Explain the difference between electric power and electric energy as used in bills from an electric company. **Assessments: Chapter Tests, Quizzes, Worksheets**	Amperage Amperes Charge Circuit Circuit breaker Complete circuit Coulomb Electric company Electric energy Electric power Electrical current Fuse Kilowatt hour (kWh) Kilowatt (kW) Load Moving Electric Charge Ohm Ohm's law Open circuit Parallel circuit Potential difference Resistance Series circuit Short circuit Voltage Work Watt	14 Days

	Chapter	HSCE's	Vocabulary	Pacing
Unit 9: Energy Transformations	Chapter 35: Electric Circuits	**P4.1A** - Account for and represent energy into and out of systems using energy transfer diagrams. **P4.2A** - Account for and represent energy transfer and transformation in complex processes (interactions). **P4.2B** - Name devices that transform specific types of energy into other types (e.g., a device that transforms electricity into motion). **P4.2C** - Explain how energy is conserved in common systems (e.g., light incident on a transparent material, light incident on a leaf, mechanical energy in a collision). **P4.2e** - Explain the energy transformation as an object (e.g., skydiver) falls at a steady velocity. **P4.2f** - Identify and label the energy inputs, transformations, and outputs using qualitative or quantitative representations in simple technological systems (e.g., toaster, motor, hair dryer) to show energy conservation. **P4.11b** - Calculate the final temperature of two liquids (same or different materials) at the same or different temperatures and masses that are combined **Assessments: Chapter Tests, Quizzes, Worksheets, Labs**	Conservation of Energy Efficiency Electric Motor Energy Energy Transfer Energy transfer diagram Heat Input Output System Temperature Thermal energy Thermal equilibrium Wave	8 Days

	Chapters	HSCE's	Vocabulary	Pacing
Unit 10: Energy and Society	Chapter 38: The Atom and the Quantum Chapter 39: The Atomic Nucleus and Radioactivity Chapter 40: Nuclear Fission and Fusion	**P4.1B -** Explain instances of energy transfer by waves and objects in everyday activities (e.g., why the ground gets warm during the day, how you hear a distant sound, why it hurts when you are hit by a baseball). **P4.2D** - Explain why all the stored energy in gasoline does not transform to mechanical energy of a vehicle. **P4.11a** - Calculate the energy lost to surroundings when water in a home water heater is heated from room temperature to the temperature necessary to use in a dishwasher, given the efficiency of the home hot water heater. **P4.12A** - Describe peaceful technological applications of nuclear fission and radioactive decay. **P4.12B** - Describe possible problems caused by exposure to prolonged radioactive decay. **P4.12C** - Explain how stars, including our Sun, produce huge amounts of energy (e.g., visible, infrared, or ultraviolet light). **P4.12d** - Identify the source of energy in fission and fusion nuclear reactions. **Assessments: Chapter Tests, Quizzes, Worksheets, Labs**	Atomic bonding principles Atomic configuration Atomic energy Atomic mass Atomic nuclei/nucleus Atomic number Atomic reaction Atomic weight By-product Chemical bond E=mc2 Earth's crust Earth's external energy sources Earth's internal energy sources Efficiency Electromagnetic radiation Electromagnetic spectrum Energy lost Energy transfer Energy transformation Forms of energy Gasoline Heat Home hot water heater Infrared light Mass to energy conversion Matter Mechanical energy Microwave Neutron Nuclear decay rate Nuclear energy Nuclear fission Nuclear force Nuclear fusion	21 Days

	Chapter	HSCE's	Vocabulary	Pacing
Unit 10: Energy and Society			Nuclear mass Nuclear reaction Nuclear stability Periodic table of the elements Potential energy Pressure Proton Radio wave Radioactive decay Radioactive isotope Ratio Release of energy Solar energy Speed of light Spontaneous nuclear reaction Star composition Stellar energy Stored energy Technological applications Temperature Thermal energy Total energy input Ultraviolet light Ultraviolet radiation Useful energy output Useful work Vacuum Visible light Waves Weight of subatomic particles X-ray	