Title	**Roxbury High School Physics B**
Type	Consensus
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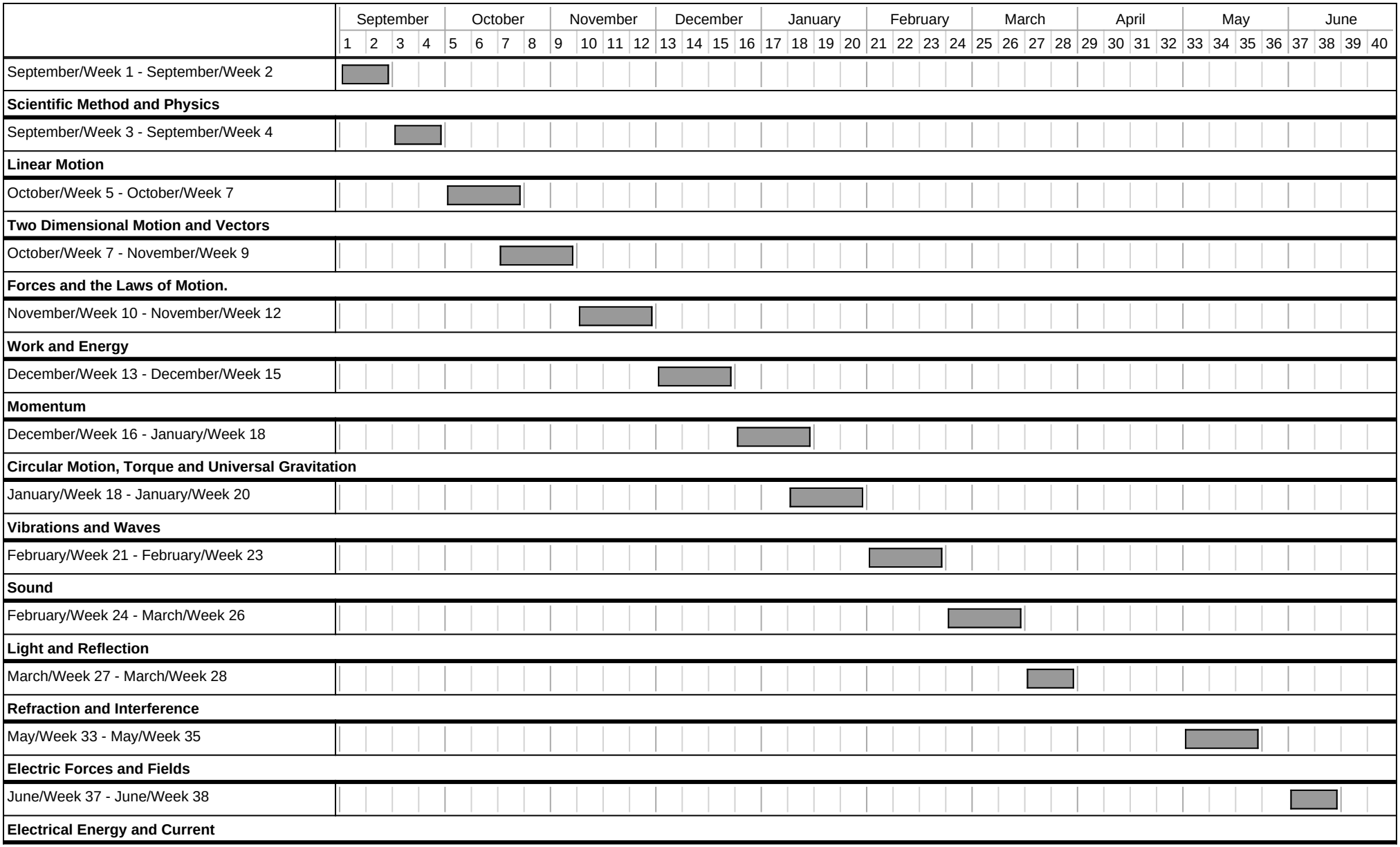
Subject	Science
Course	Physics B
Grade(s)	11 , 12
Location	Roxbury High School
Curriculum Writing History	
Notes	
Attachments	

Title : Roxbury High School Physics B
Type : Consensus



Title : Roxbury High School Physics B
Type : Consensus

Duration: September/Week 1 - September/Week 2					
UNIT NAME: Scientific Method and Physics					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Physics is the study of matter and energy and their relationships using the scientific method and the language of mathematics. Physics measurements are typically made and expressed in SI, a system that uses the metric system as a set of a base units and prefixes to describe measurements of physical quantities. Physics express their work by summarizing data in tables, and graphs and by abbreviating quantities in equations and using dimensional analysis in problem solving. Physicists collaborate in the lab and globally to share ideas, techniques and gain insight and scientific discoveries. Lab safety techniques are used in all lab activities and demos.	Explain why physics is the most basic science Describe why mathematics the language of physics? Describe the process of the scientific method and explain how the steps of the scientific method lead to collaborative scientific discovery? List the basic SI units and quantities and explain how and why is metric measurement and the SI system of units used in Physics. Identify activities and fields that involve the major areas within physics. Explain the importance of lab safety and list several examples of safe lab techniques. •	Physics is the study of the physical world, from motion and energy to light and electricity. Scientific methods include recognizing a problem, making a hypothesis, predicting, performing experiments, and formulating rules, and the collaboration of ideas. The measurement system used in science is the metric system, (SI) which is based on the meter, kilogram, and second. Larger and smaller units are obtained through use of prefixes. Lab Safety techniques are required in all lab activities.	Use significant figures, metric measurement, precision and accuracy in obtaining and recording lab data and calculations. Interpret data in tables and graphs, and recognize equations that summarize data. Distinguish between conventions for abbreviating units and quantities Use dimensional analysis to check the validity of equations. Conduct scientific measurement labs and demos to record, graph and analyze data. Utilize lab safety techniques while conducting all labs.		HS.PS2.4.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] Using Mathematics and Computational Thinking (09-12)[Regional:Next Generation Science Standards (NGSS)] Obtaining, Evaluating, and Communicating Information (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS4.5.SEP.1-Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally , graphically , textually , and mathematically). (HSPS4-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS4.3.SEP.1-Evaluate

					the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-PS4-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.SEP.1- Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: September/Week 3 - September/Week 4					
UNIT NAME: Linear Motion					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Linear motion is motion in one dimension which can be measured, graphed and calculated using position and time. Displacement, velocity and acceleration are vector quantities which have magnitude and direction. Position/time graphs display changes in motion. Problem solving using dimensional analysis uses mathematical formulas and scientific variables.	How can you describe the motion of objects in terms of changing position and time? Explain how displacement is different from distance and acceleration is different from velocity. Describe how position/ time graphs can display information about motion. Use variables of changing position and time using kinematic equations to solve for linear motions.	Displacement is a change of position, not the total distance traveled. It has magnitude and direction. The average velocity of an object during some time interval is equal to the displacement of the object divided by the time interval. Velocity has both magnitude and direction. The average acceleration of an object is equal to the change in velocity of the object divided by the time interval. It has magnitude and direction. An object thrown or dropped in the presence of Earth's gravity experiences a constant acceleration directed toward the Earth. Free fall acceleration is the same for all objects regardless of mass.	Describe motion in terms of frame of reference, displacement, time and velocity. Conduct linear motion labs and demos. Construct and interpret position/time graphs. Compare graphical representations of changing velocities and accelerations. Apply kinematic equations to calculate displacement, time, velocity and acceleration. Conduct linear motion labs and demos to observe collect and record and analyze data. Create graphs and charts and use kinematic equations to solve for vector and projectile motion.		5.1.12-Science Practices: Science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science. (09-12)[State:New Jersey] 5.1.12.A-Understand Scientific Explanations: Students understand core concepts and principles of science and use measurement and observation tools to assist in categorizing, representing, and interpreting the natural and designed world. (09-12)[State:New Jersey] 5.1.12.A.a-Mathematical, physical, and computational tools are used to search for and explain core scientific concepts and principles. (09-12)[State:New Jersey] 5.1.12.A.c-Revisions of predictions and explanations are based on systematic observations,

					accurate measurements, and structured data/ evidence. (09-12) [State:New Jersey] 5.1.12.A.3-Use scientific principles and theories to build and refine standards for data collection, posing controls, and presenting evidence. (09-12) [State:New Jersey] 5.1.12.B.2-Build, refine, and represent evidence-based models using mathematical, physical, and computational tools. (09-12)[State:New Jersey] 5.1.12.B.d-Scientific reasoning is used to evaluate and interpret data patterns and scientific conclusions. (09-12)[State:New Jersey] 5.1.12.C.b-Data and refined models are used to revise predictions and explanations. (09-12) [State:New Jersey] HS.PS1.3.SEP.1-Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine

					the design accordingly . (HS-PS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.8.SEP.1-Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.4.CCC.1-Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.5.SEP.1-Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CNS.1-Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4) (09-12)[Regional:Next

					Generation Science Standards (NGSS)] HS.PS2.1.CCC.1-Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: October/Week 5 - October/Week 7					
UNIT NAME: Two Dimensional Motion and Vectors					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Motion can occur in many direction and can be analyzed using kinematic equations and graphing techniques. Vectors are used to describe motion that has direction using arrows drawn to scale. Projectile motion occurs when an object is launched and then only acted on by gravity. The x and y components of projectile motion act independently of each other.	Differentiate among vector and scalar quantities. Create and label a motion vector. Explain the difference between vector resolution and vector addition. Recognize and list examples of projectile motion. Describe the path of a projectile as a parabola.	Vectors are quantities that have both magnitude and direction which is represented by arrows drawn to scale. Vectors can be added and resolved into components and used to examine motion in a variety of directions. Vectors can be solved mathematically or graphically. Projectile motion is the curved path that an object follows when thrown, launched or otherwise projected near the surface of the Earth. Kinematics describes the motion of objects and involves equations and variables.	Create and resolve vector equations using the triangular method of graphically adding vectors. Apply coordinate systems and the Pythagorean Theorem to add and resolve vectors mathematically. Recognize examples of projectile motion and describe the path of a projectile as a parabola. Resolve vectors into their components and apply the kinematic equations to solve. Conduct vector and projectile motion labs and demos to observe collect and record and analyze data. Create graphs and charts and use kinematic equations to solve for vector and projectile motion.		HS.PS1.1.SEP.1-Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.SEP.1-Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.2.SEP.1-Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' ow n investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate

					today as they did in the past and will continue to do so in the future. (HS-PS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.4.CCC.1-Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.5.SEP.1-Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.7.CNS.1-Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.SEP.1-Analyze data using tools, technologies, and/or models (e.g., computational,

					mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HSPS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CNS.1-Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] PS2.A-Forces and Motion (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.CCC.1-When investigating or describing a system, the boundaries and initial conditions of the system need to be defined. (HS-PS2-2) (09-12)[Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: October/Week 7 - November/Week 9					
UNIT NAME: Forces and the Laws of Motion.					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
A force on an object is a push or a pull that tends to cause a change in motion. Forces can be field or contact forces. Newton's laws of motion describe the effect of forces on objects and the idea that forces always exist in pairs. Newton's first law of motion, called Inertia, states that a body in motion, stays in motion, while a body at rest, remains at rest. Newton's second law of motion states that force is the measure of mass multiplied by acceleration. Newton's third law of motion states that for every action, their is an equal and opposite reaction. Everyday forces which act on all objects include, friction, gravity and normal forces.	Describe an object's acceleration in terms of its mass and the net force acting on it. Predict the direction and magnitude of acceleration cause by known forces. Explain the difference between mass and weight. Find the direction and magnitude of normal forces. Describe air resistance as a form of friction. Use coefficients of friction to calculate frictional force.	Force is a vector quantity that causes acceleration when unbalanced. Force can act either through physical contact or at a distance. A free-body diagram shows only the forces that act on an object which affect the motion of the object. Inertia is the tendency of an object to remain at rest or remain in motion. The net force of an object is equal to it's mass and acceleration and is measured in newtons. For every action, there is an equal and opposite reaction. The weight of an object is equal to its mass times the acceleration of the object due to gravity. Normal force is the force that acts on an object in a perpendicular direction to the surface of the object.	Describe how force affects the motion of an object. Interpret and construct free-body diagrams. Explain the relationship between the motion of an object and the net external force. Calculate the force required to bring an object into equilibrium. Conduct labs and demos to observe collect and record and analyze data for force and motion. Create graphs and charts and use kinematic equations to solve for force and motion.		HS.PS1.2.SEP.1-Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' ow n investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] PS2.A-Forces and Motion (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.DCI.PS2.A.1-Newton's second law accurately predicts changes in the motion of macroscopic objects. (HS-PS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CCC.1-Empirical evidence is required to differentiate between cause and

		Friction is the force that acts in the opposite direction to motion.			correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] PS2.A-Forces and Motion (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.4.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS3.4.SEP.1-Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials,

					cost, risk, time), and refine the design accordingly. (HS-PS3-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS4.5.SEP.1- Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally , graphically , textually , and mathematically). (HSPS4-5) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: November/Week 10 - November/Week 12					
UNIT NAME: Work and Energy					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
In Physics, work is done when an object is moved as a result of force. Energy of motion, called kinetic energy depends on mass and speed. Energy can neither be created nor destroyed but it can be converted from one form to another. Power can be calculated by dividing work by time interval.	Identify when work is being performed in a variety of situations. Relate the concepts of energy, time and power. Calculate power in two different ways. Explain the effects of machines on work and power.	Work is done on an object when a net force acts on it to displace it in the parallel direction to the motion of the object. Objects in motion have kinetic energy because of their mass and speed. Potential energy is assosiacted with an objects postion and can be gravitational or elastic. Energy can change form but cannot be created nor destroyed. Power is the rate at which work is done on an object. Machines with different power ratings do the same amount of work in less time.	Recognize the difference between the scientific and ordinary definitions of work. Calculate the net work done when many forces are applied to an object. Identify several forms of energy. Classify different types of potential energy. Identify situations of which conservation of mechanical energy is valid. Conduct work and energy labs and demos to observe collect and record and analyze data. Create graphs and charts and use kinematic equations to solve for work and energy.		HS.PS1.3.SEP.1-Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly . (HS-PS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.8.SEP.1-Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.SEP.1-Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple

					formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] Energy and Matter (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.4.CCC.1-Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS1.5.SEP.1-Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] Energy and Matter (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.7.CCC.1-The total amount of energy and matter in closed systems is conserved. (HS-PS1-7) (09-12)

					[Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.SEP.1-Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HSPS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CNS.1-Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
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Title : Roxbury High School Physics B
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Duration: December/Week 13 - December/Week 15					
UNIT NAME: Momentum					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Momentum is the product of mass multiplied by velocity and in known from movement or progress in motion. Impulse is the product of force multiplied by time. Collisions can be elastic or inelastic. Very few are considered perfectly elastic or inelastic. Momentum is conserved in collisions.	Describe changes in momentum in terms of force and time. Compare the total momenta of two objects before and after they interact. State the law of conservation of momentum. Identify different types of collisions. Explain how car bumpers that collapse on impact and air bags protect during a collision.	Momentum is a vector quantity defined as the product of an object's mass and velocity. Impulse is the product of the force and time interval. Momentum is conserved. Inelastic collision is when objects deform, perfectly inelastic collision is when objects stick together and an elastic collision is when objects return to their original shapes and move away separately. Few collisions are perfectly elastic or inelastic.	Compare and describe the momentum of a variety of moving objects. Identify examples of change in the momentum of an object. Predict the final velocities of objects after a collision, given the initial velocities. Calculate momentum equations and the final velocity of an object in a perfectly inelastic and elastic collision. Conduct momentum, impulse and collision labs and demos. Graph, diagram and interpret momentum and collision data.		HS.PS2.1.SEP.1-Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HSPS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CNS.1-Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.3.DCI.PS2.A.1-If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by

					changes in the momentum of objects outside the system. (HS-PS2-2),(HS-PS2-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS4.3.CNS.1-A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HSPS4-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS3.2.CCC.1-Energy cannot be created or destroy ed—only moves between one place and another place, between objects and/or fields, or between systems. (HS-PS3-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS3.1.DCI.PS3.A.1-Energy is a quantitative property of a system that

					depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. (HSPS3-1), (HS-PS3-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.DCI.PS2.A.1-Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. (HS-PS2-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.DCI.PS2.A.2-If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS-PS2-2),(HS-PS2-3) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
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Title : Roxbury High School Physics B
Type : Consensus

Duration: December/Week 16 - January/Week 18					
UNIT NAME: Circular Motion, Torque and Universal Gravitation					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Circular motion occurs when an object rotates about it's axis. Tangential speed, centripetal acceleration and centripetal force are key components of circular motion. Gravitational force acts between all masses and is a field force. Newton's law of gravitation accounts for ocean tides. Torque depends on the force and the lever arm. Simple machines change the magnitude and direction of the input force causing a mechanical advantage.	Explain that the outward force caused by inertia is mistakenly called centrifugal force Distinguish between torque and force. Identify the six types of simple machines. Explain how simple machines make work easier. Calculate the mechanical advantage of a simple machine.	An object that revolves around a single axis undergoes circular motion. An object in circular motion has a centripetal acceleration and a centripetal force, which are both directed toward the center of the circular path. Every particle in the universe is attracted to everty other particle vy a force that is directly proportional to the square of the distance between the particles. Torque is a measure of a force's ability to rotate an object. The torque of an object depends on the magnitude of the applied force and on the lever arm. Simple machines provide a mechanical advantage.	Solve problems involving centripetal acceleration. Solve problems involving centripetal force. Use Newton's law of universal gravitation to account for various phenomenon. Apply Newton's law of universal gravitation to solve problems. Calculate the magnitude of a torque on an object. Conduct labs and student demos of circular motion, torque and Universal Gravitation and Center of Mass.		HS.PS1.1.SEP.1-Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.1.CCC.1-Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.SEP.1-Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.5.SEP.1-Apply

					scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.6.SEP.1-Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.6.CCC.1-Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.7.SEP.1-Use mathematical representations of phenomena to support claims. (HS-PS1-7) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.7.CNS.1-Science assumes the universe is a

					vast single system in which basic laws are consistent. (HS-PS1-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.SEP.1-Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HSPS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CNS.1-Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CCC.1-Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.3.SEP.1-Apply scientific ideas to solve a design problem, taking into account possible

					unanticipated effects. (HS-PS2-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.4.DCI.PS2.B.1- Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.4.DCI.PS2.B.2- Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4),(HS-PS2-5) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: January/Week 18 - January/Week 20					
UNIT NAME: Vibrations and Waves					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
In simple harmonic motion the restoring force is proportional to displacement. Simple harmonic motion is measured using period and frequency. A wave is the motion of a disturbance. Transverse wave energy moves perpendicular to the direction the wave is traveling while longitudinal waves energy moves parallel to the direction the energy is moving. Waves interactions produce constructive and destructive interference, may be reflected and inverted.	Explain how force, velocity, and acceleration change as the object vibrates with simple harmonic motion. Recognize the relationship between period and frequency. Calculate the period and frequency of an object vibrating with simple harmonic motion. Apply the relationship among wave speed, frequency and wavelength to solve problems.	In simple harmonic motion, the restoring force is proportional to the displacement. A mass-spring system vibrates with simple harmonic motion and the spring force is calculated with Hooke's Law. The period of a mass-spring system depends only on the mass and the spring constant. The period of a simple pendulum depends only on the length of the pendulum. As a wave travels, the particles of the media vibrate around an equilibrium position. In transverse waves, vibrations are perpendicular tot he direction of the wave motion. In longitudinal waves, vibrations are parallel tot he direction of wave motion. Wave speed equals	Identify the conditions of simple harmonic motion. Calculate the spring force using Hooke's Law. Identify the amplitude of vibration. Differentiate between pulse waves and periodic waves. Interpret wave-forms of transverse and longitudinal waves. Conduct vibration and wave phenomenon labs and demos. Create graphs and charts to analyze lab data and draw conclusions.		HS.PS1.6.SEP.1-Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] Scientific Knowledge Assumes an Order and Consistency in Natural Systems (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.7.CNS.1-Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.SEP.1-Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

		frequency times wavelength. Standing waves are formed when two waves that have the same frequency, amplitude, and wavelength travel in opposite directions and interfere.			(HSPS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CNS.1-Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS3.5.SEP.1-Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS3-2),(HSPS3-5) (09-12)[Regional:Next Generation Science Standards (NGSS)] PS3.C-Relationship Between Energy and Forces (09-12) [Regional:Next Generation Science Standards (NGSS)] PS3.C-Relationship Between Energy and Forces (09-12) [Regional:Next Generation Science Standards (NGSS)]

					HS.PS4.1.DCI.PS4.A.1-The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. (HS-PS4-1) (09-12)[Regional:Next Generation Science Standards (NGSS)] PS4.A-Wave Properties (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS4.3-Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS4.3.CNS.1-A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is

					discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HSPS4-3) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS4.3.DCI.PS4.A.1- [From the 3–5 grade band endpoints] Waves can add or cancel one another as they cross, depending on their relative phase (i.e., relative position of peaks and troughs of the waves), but they emerge unaffected by each other. (Boundary : The discussion at this grade level is qualitative only ; it can be based on the fact that two different sounds can pass a location in different directions without getting mixed up.) (HS-PS4-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS4.3.DCI.PS4.B.3- Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model

					explains other features. (HS-PS4-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS4.4-Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS4.5.SEP.1-Communicate technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally , graphically , textually , and mathematically). (HSPS4-5) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: February/Week 21 - February/Week 23					
UNIT NAME: Sound					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Sound waves are longitudinal waves categorized by frequency. Sound intensity is measured in decibels. Resonance occurs when the frequency of a force applied to a system matches the natural frequency of the system resulting in a large amplitude of vibration. Harmonics are integral multiples of the fundamental frequency.	Relate frequency to pitch. List the characteristics of sound waves. Explain the significance of the Doppler effect and provide an example. Calculate the intensity of sound waves produced at the same distance with a variety of power input values. Describe the effect of resonance on objects.	The frequency of a sound wave depends on it's pitch. The speed of sound depends on the medium. The relative motion between the source of waves and the observer creates an apparent frequency shift known as the Doppler effect. Intensity and frequency determine which sounds are audible. Decibel level is a measure of relative intensity on a logarithmic scale. A forced vibration at the natural frequency produces resonance. The human ear transits vibrations that cause nerve impulses. Harmonics are integral multiples of the fundamental frequency.	Explain how sound waves are produced. Relate frequency to pitch. Compare the speed of sound in various media. Recognize the Doppler effect and determine the direction of frequency shift when there is a relative motion between a source and an observer. Relate intensity, decibel lvel and perceived loudness. Explain why resonance occurs. Differentiate between the harmonic series of open and closed pipes. Relate harmonics and timbre. Conduct sound labs and demos to observe collect and record and analyze data. Create graphs and charts and use kinematic equations to solve for		HS.PS1.3.SEP.1-Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly . (HS-PS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.8.SEP.1-Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.SEP.1-Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple

			sound.		formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.5.SEP.1-Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.6.SEP.1-Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.7.SEP.1-Use mathematical representations of phenomena to support claims. (HS-PS1-7) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CNS.1-Theories and laws provide explanations in science.

					(HS-PS2-1),(HS-PS2-4) (09-12)[Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: February/Week 24 - March/Week 26					
UNIT NAME: Light and Reflection					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Light is finite and a component of Electromagnetic Spectrum. Flat mirrors reflect light. The law of reflection states that the angle of incidence is equal to the angle of reflection. Concave and convex are curved mirrors that reflect light. Ray diagrams and the mirror equation provide techniques for investigating the properties of curved mirrors. Color is created by the reflection and absorption of light. Polarization of light is by transmission, reflection and scattering.	Recognize that light has a finite speed. Identify the components of the electromagnetic spectrum. Differentiate between specular and diffuse reflection of light. Describe the nature of images formed by flat mirrors. Recognize how additive colors, pigment and polarization effect light.	Light is electromagnetic radiation that consists of oscillating electric and magnetic fields with different wavelengths. The speed of light is calculated by the frequency and the wavelength of the electromagnetic radiation. Light obeys the law of reflection, which states that the incident and the reflected angles of light are equal. Flat mirrors form virtual images that are the same distance from the mirrors surface as the object is. The mirror equation relates object distance, image distance and focal length of a spherical mirror. The magnification equation relates image height or distance to object height or distance, respectively. Light of different colors can be produced by	Identify the components of the electromagnetic spectrum. Calculate the frequency or wavelength of EMR. Apply the law of reflection for flat mirrors. Calculate the distances and focal lengths using the mirror equation. Draw ray diagrams for concave and convex mirrors. Distinguish between real and virtual images. Conduct labs and demos on light and reflection. Create, analyze and interpret diagrams, charts and graphs for light and reflection. Conduct problem solving for light and reflection.		HS.PS1.4.CCC.1-Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.5.SEP.1-Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.6.SEP.1-Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CCC.1-Empirical evidence is required to differentiate

		adding light consisting of the primary additive colors. Pigments can be produced by combining subtractive colors. Light can be linearly polarized by transmission, reflection or scattering.			between cause and correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.2.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS3.4.SEP.1-Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS3-4) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: March/Week 27 - March/Week 28					
UNIT NAME: Refraction and Interference					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Refraction is the bending of light and can be measured using the Snell's law equation. The index of refraction is the ratio of the speed of light in a vacuum to the speed of light in the medium. Objects appear to be in different positions due to refraction. Snell's law determines the angle of refraction. Lenses bend light in a concave or convex manner. Optical phenomenon can be produced by variations of light in the Earth's atmosphere.	Explain how a light ray traveling from one media to another bends towards the normal. Explain why a clear stream always appears to be more shallow than it is. What causes a wave to bend? What causes the refraction of light? What causes the dispersion of light? What are the conditions necessary for seeing a rainbow? What causes the appearance of a mirage? Solve lens equations using Snell's law.	According to Snell's law, as a light ray travels from one medium into another medium where its peed is differnt, the light ray will change its direction unless it travels along the normal. When light passes from a medium with a smaller index of refraction to one with a larger index of refraction, the ray bends toward the normal. The image produced by a converging lens is real and inverted when the object is outside the focal point. The location of an image created by a lens can be found using either a ray diagram or the thin lens equation. Mirages and visibility of the sun after it has physically set are natural phenomena that can be attributed to reflection of light in Earth's atmosphere.	Recognize the situations in which refraction will occur. Identify which direction light will bend when it passes from one medium to another. Solve problems using Snell's law. Use ray diagrams to find the position of an image produced by a converging or diverging lens, and identify the image as real or virtual. Solve problems using the thin-lens equation. Calculate the magnification of lenses. Describe the positioning of lenses in compound microscopes and refracting telescopes. Conduct refraction labs and demos. Create, interpret and analyze, graphs, charts and diagrams.		HS.PS1.3.SEP.1-Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly . (HS-PS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.8.SEP.1-Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.SEP.1-Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple

			Identify the conditions required for interference to occur. Predict the location of interference using the equation for double-slit interference. Describe how light waves bend around obstacles and produce bright and dark fringes. Describe the properties of laser light.		formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.2.SEP.1-Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' ow n investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.5.SEP.1-Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.6.SEP.1-Refine a solution to a complex real-world problem, based on

					scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.7.SEP.1-Use mathematical representations of phenomena to support claims. (HS-PS1-7) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: May/Week 33 - May/Week 35					
UNIT NAME: Electric Forces and Fields					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
The basic properties of electric charge are positive, negative and neutral. Like charges repel, opposite charges attract. Electrical conductors are materials in which charge can move freely. Electrical insulators are materials in which charges can not move freely. Electric field is a region where an electric force on a test charge can be detected.	How are conductors different from insulators? What determines the direction of the electric force between two atoms? Identify examples of electric forces in everyday life. What is an electric field? Why can't two field lines from the same field cross one another?	There are two kinds of electric charge: positive and negative. Like charges repel, and unlike charges attract. Electric charge is conserved. The fundamental unit of charge is e, the magnitude of the charge is the single electron or proton. Conductors and insulators can be charged by contact. Conductors also can be charged by induction. According to Coulomb's law, the electric force between two charges is proportional to the magnitude of each othe charges and inversely proportional to the square to the distance between them. An electric field exists in the region around a charged object. Field lines are tangent to the electric field vector at any point. The number of lines is proportional to the field strength.	Understand the basic properties of electronic charge. Differentiate between conductors and insulators. Distinguish between charging by contact, induction and polarization. Calculate electric force using Coulomb's law. Compare electric force with gravitational force. Calculate electric field strength. Draw and interpret electric field lines. Conduct electric force and field labs, demos and projects. Create and interpret diagrams, charts and graphs.		HS.PS1.3.DCI.PS2.B.2-Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS1-1),(HS-PS1-3), (HSPS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.3.CCC.1-Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.8.SEP.1-Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.SEP.1-

					Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.DCI.PS2.B.2- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS1-1),(HS-PS1-3), (HSPS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.CCC.1- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-PS2-6) (09-12)[Regional:Next Generation Science

					Standards (NGSS)] HS.PS1.2-Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS1.5.SEP.1-Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.6.CCC.1-Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.7.SEP.1-Use mathematical representations of phenomena to support claims. (HS-PS1-7) (09-12) [Regional:Next Generation Science Standards (NGSS)]

					HS.PS2.1.SEP.1-Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HSPS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CNS.1-Theories and laws provide explanations in science. (HS-PS2-1),(HS-PS2-4) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.CCC.1-Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-1),(HS-PS2-5) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.4-Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. (09-12) [Regional:Next Generation

Title : Roxbury High School Physics B
Type : Consensus

					Science Standards (NGSS)]
Plans:					

Title : Roxbury High School Physics B
Type : Consensus

Duration: June/Week 37 - June/Week 38					
UNIT NAME: Electrical Energy and Current					
Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Assessment**	**Standards**
Voltage is an "electric pressure" that can produce a flow of charge, or current, within a conductor. Electrons in a wire are like water in a pipe; whenever a little water enters one end, almost immediately the same amount of water exits the other end. Ohm's law state that the current in a circuit is directly proportional to the voltage impressed across the circuit and inversely proportional to the resistance of the circuit. The damaging effects of electric shock are the result of current passing through the body. Electric current may by DC or AC. Direct current always flows in one direction. Alternating current is electric current that repeatedly changes direction.	What happens when the ends of a conductor are at different electrical potentials? What are two voltage sources used to provide the energy that allows charges to move steadily. What does Ohm's law state? What causes the damaging effects of electric shock? What are two types of electric current? Why is the drift speed of electrons in a current carrying wire extremely low? What is the source of electrons in a circuit?	Electrical potential energy is energy that is a charged object has because of its shape and position in an electrical field. The capacitance, C, of an object is the magnitude of the charge, Q, on each of a capacitor's plates divided by the potential difference, V. Current is the rate of charge movement. Resistance equals potential difference divided by current. Electric power is the rate of conversion of electrical energy. Electric companies measure energy consumed in kilowatt hours.	Distinguish between electrical potential energy, electric potential and potential difference. Solve problems involving electrical energy and potential difference. Describe the energy conversions that occur in a battery. Relate the capacitance to the storage of electrical potential energy in the form of separated charges. Calculate the energy stored in a capacitor. Describe the basic properties of electric current, and solve problems relating current, charge and time. Calculate resistance, current and potential difference by using the definition of resistance. Differentiate between direct current and alternating current.		HS.PS1.3.SEP.1-Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly . (HS-PS1-3) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.3.DCI.PS2.B.2-Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS1-1),(HS-PS1-3), (HSPS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.8.SEP.1-Develop a model based on evidence to illustrate the relationships between

			Calculate electric power and the cost of running appliances.		systems or between components of a system. (HS-PS1-8) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.SEP.1- Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.DCI.PS1.A.1- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3), (secondary to HS-PS2-6) (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS2.6.DCI.PS2.B.2- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (HS-PS1-1),(HS-PS1-3),

					(HSPS2-6) (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS1.2-Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (09-12)[Regional:Next Generation Science Standards (NGSS)] HS.PS1.5-Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. (09-12) [Regional:Next Generation Science Standards (NGSS)] HS.PS2.1.SEP.1-Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HSPS2-1) (09-12) [Regional:Next Generation Science Standards (NGSS)]

					HS.PS2.2.SEP.1-Use mathematical representations of phenomena to describe explanations. (HS-PS2-2), (HS-PS2-4) (09-12) [Regional:Next Generation Science Standards (NGSS)]
Plans:					