New York State Core Curriculum
Contents Standards Mapping

PHYSICS	Boardworks High School Physics Presentation
Key Idea 4 – Energy exists in many forms, and when these forms change energy is conserved.	
Performance Indicator 4.1 Students can observe and describe transmission of various forms of energy.	
4.1a All energy transfers are governed by the law of conservation of energy.	Conservation of Energy
4.1b Energy may be converted among mechanical, electromagnetic, nuclear, and thermal forms.	Energy Transfers
4.1c Potential energy is the energy an object possesses by virtue of its position or condition. Types of potential energy include gravitational and elastic.	Gravitational and Potential Energy
4.1d Kinetic energy is the energy an object possesses by virtue of its motion.	Kinetic Energy
4.1e In an ideal mechanical system, the sum of the macroscopic kinetic and potential energies (mechanical energy) is constant.	Conservation of Energy
4.1f In a nonideal mechanical system, as mechanical energy decreases there is a corresponding increase in other energies such as internal energy.	–
4.1g When work is done on or by a system, there is a change in the total energy of the system.	Work
4.1h Work done against friction results in an increase in the internal energy of the system.	–
4.1i Power is the time-rate at which work is done or energy is expended.	Power
4.1j Energy may be stored in electric or magnetic fields. This energy may be transferred through conductors or space and may be converted to other forms of energy.	Motors
4.1k Moving electric charges produce magnetic fields. The relative motion between a conductor and a magnetic field may produce a potential difference in the conductor.	Magnetism, Current and Force Motors
4.1l All materials display a range of conductivity. At constant temperature, common metallic conductors obey Ohm's Law.	Calculating Resistance
4.1m The factors affecting resistance in a conductor are length, cross-sectional area, temperature, and resistivity.	Current, Voltage and Resistance Factors Affecting Resistance 1 Factors Affecting Resistance 2
4.1n A circuit is a closed path in which a current can exist. (Note: Use conventional current.)	Circuit Diagrams Current and Potential Difference
4.1o Circuit components may be connected in series or in parallel. Schematic diagrams are used to represent circuits and circuit elements.	Circuit Diagrams Series and Parallel Circuits
4.1p Electrical power and energy can be determined for electric circuits.	Electrical Power

Performance Indicator 1.2 Students can explain variations in wavelength and frequency in terms of the source of the vibrations that produce them, e.g. molecules, electrons, and nuclear particles.	
4.3a An oscillating system produces waves. The nature of the system determines the type of wave produced.	Longitudinal Waves Transverse Waves Waves
4.3b Waves carry energy and information without transferring mass. This energy may be carried by pulses or periodic waves.	Waves
4.3c The model of a wave incorporates the characteristics of amplitude, wavelength, frequency, period, wave speed, and phase.	Longitudinal Waves Transverse Waves
4.3d Mechanical waves require a material medium through which to travel.	Waves
4.3e Waves are categorized by the direction in which particles in a medium vibrate about an equilibrium position relative to the direction of propagation of the wave, such as transverse and longitudinal waves.	Longitudinal Waves Transverse Waves Waves
4.3f Resonance occurs when energy is transferred to a system at its natural frequency.	Interference
4.3g Electromagnetic radiation exhibits wave characteristics. Electromagnetic waves can propagate through a vacuum.	Electromagnetic Waves Waves
4.3h When a wave strikes a boundary between two media, reflection, transmission, and absorption occur. A transmitted wave may be refracted.	Electromagnetic Waves Reflection Refraction
4.3i When a wave moves from one medium into another, the wave may refract due to a change in speed. The angle of refraction (measured with respect to the normal) depends on the angle of incidence and the properties of the media (indices of refraction).	Refraction Refractive Index
4.3j The absolute index of refraction is inversely proportional to the speed of a wave.	Refractive Index
4.3k All frequencies of electromagnetic radiation travel at the same speed in a vacuum.	Electromagnetic Waves
4.3l Diffraction occurs when waves pass by obstacles or through openings. The wavelength of the incident wave and the size of the obstacle or opening affect how the wave spreads out.	Diffraction Interference
4.3m When waves of a similar nature meet, the resulting interference may be explained using the principle of superposition. Standing waves are a special case of interference.	Interference Standing Waves Superpostion and Interference
4.3n When a wave source and an observer are in relative motion, the observed frequency of the waves traveling between them is shifted (Doppler effect).	Doppler Effect
Key Idea 5. Energy and matter interact through forces that result in changes in motion.	

Performance Indicator 5.1 Students can explain and predict different patterns of motion of objects (e.g. linear and uniform circular motion, velocity and acceleration, momentum and inertia).	
5.1a Measured quantities can be classified as either vector or scalar.	Momentum Speed and Velocity Vectors and Scalars
5.1b A vector may be resolved into perpendicular components.	Vectors and Scalars
5.1c The resultant of two or more vectors, acting at any angle, is determined by vector addition.	Vectors and Scalars
5.1d An object in linear motion may travel with a constant velocity or with acceleration. (Note: testing of acceleration will be limited to cases in which acceleration is constant.)	Acceleration Speed and Velocity
5.1e An object in free fall accelerates due to the force of gravity. Friction and other forces cause the actual motion of a falling object to deviate from its theoretical motion. (Note: initial velocities of objects in free fall may be in any direction.)	Friction Projectiles
5.1f The path of a projectile is the result of the simultaneous effect of the horizontal and vertical components of its motion; these components act independently.	Projectiles
5.1g A projectile's time of flight is dependent upon the vertical component of its motion.	Projectiles
5.1h The horizontal displacement of a projectile is dependent upon the horizontal component of its motion and its time of flight.	Projectiles
5.1i According to Newton's First Law, the inertia of an object is directly proportional to its mass. An object remains at rest or moves with constant velocity, unless acted upon by an unbalanced force.	Newton's First Law
5.1j When the net force on a system is zero, the system is in equilibrium.	Newton's First Law
5.1k According to Newton's Second Law, an unbalanced force causes a mass to accelerate.	Newton's Second Law
5.1l Weight is the gravitational force with which a planet attracts a mass. The mass of an object is independent of the gravitational field in which it is located.	Gravity Mass and Weight
5.1m The elongation or compression of a spring depends upon the nature of the spring (its spring constant) and the magnitude of the applied force.	Springs
5.1n Centripetal force* is the net force which produces centripetal acceleration. In uniform circular motion, the centripetal force is perpendicular to the tangential velocity.	Circular Motion
5.1o Kinetic friction is a force that opposes motion.	Friction
5.1p The impulse imparted to an object causes a change in its momentum.	Changes in Momentum
5.1q According to Newton's Third Law, forces occur in action/reaction pairs. When one object exerts a force on a second, the second exerts a force on the first that is equal in magnitude and opposite in direction.	Newton's Third Law
5.1r Momentum is conserved in a closed system. (Note: Testing will be limited to momentum in one dimension.)	Conservation of Momentum Momentum
5.1s Field strength and direction are determined using a suitable test particle.	–

5.1t Gravitational forces are only attractive, whereas electrical and magnetic forces can be attractive or repulsive.	–
5.1u The inverse square law applies to electrical and gravitational fields produced by point sources.	–
Performance Indicator 5.3 Students can compare energy relationships within an atom's nucleus to those outside the nucleus.	
5.3a States of matter and energy are restricted to discrete values (quantized).	–
5.3b Charge is quantized on two levels. On the atomic level, charge is restricted to multiples of the elementary charge (charge on the electron or proton). On the subnuclear level, charge appears as fractional values of the elementary charge (quarks).	Quarks and Antimatter
5.3c On the atomic level, energy is emitted or absorbed in discrete packets called photons.	The Photoelectric Effect
5.3d The energy of a photon is proportional to its frequency.	The Photoelectric Effect
5.3e On the atomic level, energy and matter exhibit the characteristics of both waves and particles.	The Photoelectric Effect Wave Properties of Particles
5.3f Among other things, mass-energy and charge are conserved at all levels (from subnuclear to cosmic).	–
5.3g The Standard Model of Particle Physics has evolved from previous attempts to explain the nature of the atom and states that: • atomic particles are composed of subnuclear particles • the nucleus is a comglomeration of quarks which manifest themselves as protons and neutrons • each elementary particle has a corresponding antiparticle	Quarks and Antimatter Structure of the Atom
5.3h Behaviors and characteristics of matter, from the microscopic to the cosmic levels, are manifestations of its atomic structure. The macroscopic characteristics of matter, such as electrical and optical properties, are the result of microscopic interactions.	–
5.3i The total of the fundamental interactions is responsible for the appearance and behavior of the objects in the universe.	–
5.3j The fundamental source of all energy in the universe is the conversion of mass into energy.	–