Grade 12 Physics
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STANDARD	PERFORMANCE INDICATORS	PACING DAYS	RESOURCES (Print, Visual, Technology, Manipulatives)	ASSESSMENT (Evidence & Scoring Guides)
Unit 5 (cont.)				
P.S.4.4B PH	• Students explain variations in wavelength and frequency in terms of the source of the vibrations that produce them, e.g., molecules, electrons, and nuclear particles.	1-3	o Textbook o Static Electricity Demo o Capacitor Demo o Ampere Balance Demo o Electric Heater Demo o Potentiometer and Dimmer Switch Demo o Motor and Generator Demo o Websites: www.particleadventure.org www.physlink.org o Videos	o Static Electricity Lab o Coulomb's Law Lab o Electric Fields Lab o Ohm's Law Lab o Series Circuit Lab o Parallel Circuit Lab o Magnetic Fields Lab o Electric Current and Magnetic Fields Lab o Electric Motor Lab o Electric Generator Lab
P.S.4.4B4 PH	• Mechanical waves require a material medium through which to travel.			
P.S.4.4B5 PH	• 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.			
P.S.4.4B14 PH	• When a wave source and an observer are in relative motion, the observed frequency of the waves traveling between them is shifted (Doppler effect).			
P.S.4.4B6 PH	• Resonance occurs when energy is transferred to a system at its natural frequency.	2		
P.S.4.4B7 PH	• Electromagnetic radiation exhibits wave characteristics. Electromagnetic waves can			

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STANDARD	PERFORMANCE INDICATORS	PACING DAYS	RESOURCES (Print, Visual, Technology, Manipulatives)	ASSESSMENT (Evidence & Scoring Guides)
	propagate through a vacuum.		o Websites	o Magnetic Flux Lab
P.S.4.4B8 PH	• When a wave strikes a boundary between two media, reflection*, transmission, and absorption occur. A transmitted wave may be refracted.	5		
P.S.4.4B9 PH	• 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).*			
P.S.4.4B10 PH	• The absolute index of refraction is inversely proportional to the speed of a wave.*			
P.S.4.4B11 PH	• All frequencies of electromagnetic radiation travel at the same speed in a vacuum.*			
P.S.4.4B12 PH	• 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.			
P.S.4.4B13 PH	• When waves of a similar nature meet, the resulting interference may be explained using the			

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	principle of superposition. Standing waves are a special case of interference.			
Unit 6				
P.S.4.3	• Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.	5	o Textbook o Static Electricity Demo o Capacitor Demo o Ampere Balance Demo o Electric Heater Demo o Potentiometer and Dimmer Switch Demo o Motor and Generator Demo o Websites: www.particleadventure.org www.physlink.org	o Static Electricity Lab o Coulomb's Law Lab o Electric Fields Lab o Ohm's Law Lab o Series Circuit Lab o Parallel Circuit Lab o Magnetic Fields Lab o Electric Current and Magnetic Fields Lab o Electric Motor Lab
P.S.4.3A ES	• Students explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.			
P.S.4.3A CH	• Students explain the properties of materials in terms of the arrangement and properties of the atoms that compose them.			
P.S.4.3A1 CH	• The modern model of the atom has evolved over a long period of time through the work of many scientists.	2		
P.S.4.3A2 CH	• Each atom has a nucleus, with an overall positive charge, surrounded by negatively charged electrons.			
P.S.4.3A3 CH	• Subatomic particles contained in the nucleus include protons and neutrons.			

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P.S.4.3A6 CH	• The mass of each proton and each neutron is approximately equal to one atomic mass unit. An electron is much less massive than a proton or a neutron.	4	o Videos o Websites	o Electric Generator Lab o Magnetic Flux Lab
P.S.4.3A7 CH	• The number of protons in an atom (atomic number) identifies the element. The sum of the protons and neutrons in an atom (mass number) identifies an isotope. Common notations that represent isotopes include: ^{14}C, $^{14}{}_{6}C$, carbon-14, C-14.			
P.S.4.3A8 CH	• In the wave-mechanical model (electron cloud model) the electrons are in orbital's, which are defined as the regions of the most probably electron location (ground state).			
P.S.4.3A9 CH	• Each electron in an atom has its own distinct amount of energy.			
P.S.4.3A10 CH	• When an electron in an atom gains a specific amount of energy, the electron is at a higher energy state (excited state).	4		
P.S.4.3A11 CH	• When an electron returns from a higher energy state to a lower energy state, a specific amount of			

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	energy is emitted. This emitted energy can be used to identify an element.			
P.S.4.3A12 CH	• The outermost electrons in an atom are called the valence electrons. In general, the number of valence electrons affects the chemical properties of an element.	2		
P.S.4.3A13 CH	• Atoms of an element that contain the same number of protons but a different number of neutrons are called isotopes of that element.			
P.S.4.3A14 CH	• The average atomic mass of an element is the weighted average of the masses of its naturally occurring isotopes.			
P.S.4.3A15 CH	• Stability of an isotope is based on the ratio of neutrons and protons in its nucleus. Although most nuclei are stable, some are unstable and spontaneously decay, emitting radiation.	3		
P.S.4.3A16 CH	• Spontaneous decay can involve the release of alpha particles, beta particles, positrons, and/or gamma radiation from the nucleus of an unstable isotope. These emissions differ in mass, charge, ionizing power, and penetrating power.			

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P.S.4.5	• Energy and matter interact through forces that result in changes in motion.	3		
P.S.4.5C PH	• Students can compare energy relationships within an atom's nucleus to those outside the nucleus.			
P.S.4.5C1 PH	• States of matter and energy are restricted to discrete values (quantized).			
P.S.4.5C2 PH	• 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 sub nuclear level, charge appears as fractional values of the elementary charge (quarks).			
P.S.4.5C3 PH	• On the atomic level, energy is emitted or absorbed in discrete packets called photons.*			
P.S.4.5C5 PH	• On the atomic level, energy and matter exhibit the characteristics of both waves and particles.			
P.S.4.5C4 PH	• The energy of a photon is proportional to its frequency.*			
P.S.4.5C6 PH	• Among other things, mass-energy and charge are conserved at all levels (from sub nuclear to cosmic).			

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P.S.4.5C7 PH	• 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 sub nuclear particles; the nucleus is a conglomeration of quarks which manifest themselves as protons and neutrons; and each elementary particle has a corresponding antiparticle.	4		
P.S.4.5C8 PH	• Behavior 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 particles, are the result of microscopic interactions.			
P.S.4.5C9 PH	• The total of the fundamental interactions is responsible for the appearance and behavior of the objects in the universe.	3		
P.S.4.5C10 PH	• The fundamental source of all energy in the universe is the conversion of mass into energy.*			

Curriculum Guidelines for Fourth Quarter

- Static Electricity Magnetism The Atom

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- Electric Field
- Electric Current
- Series and Parallel Circuits

Electro Magnetic Induction
Electric and Magnetic Fields
Quantum Theory

The Nucleus
Nuclear Application