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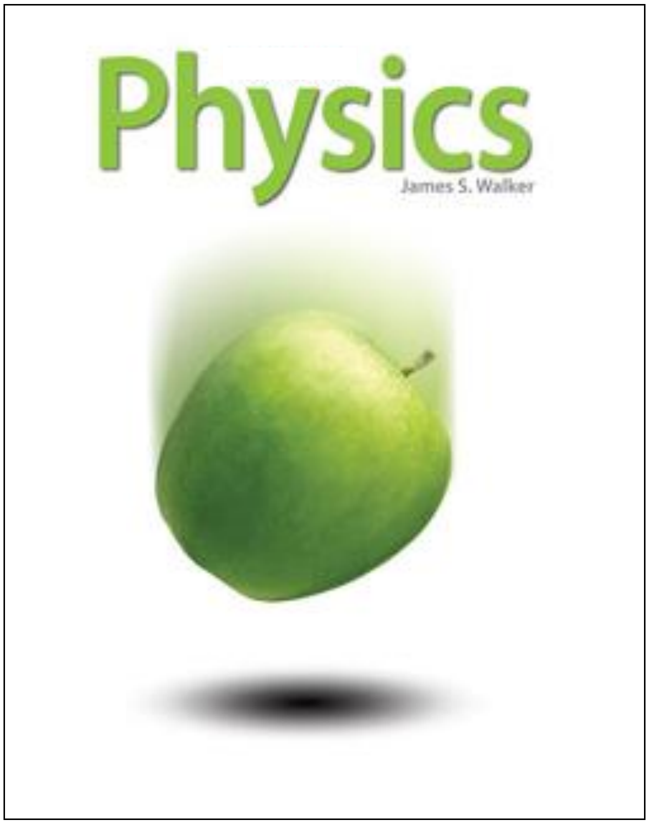

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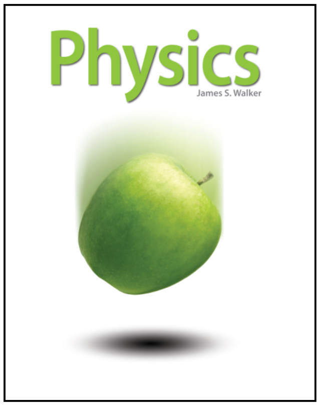

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Tennessee Academic Standards for Science Physics	**Pearson Physics ©2014**
PHYSICS: ACADEMIC STANDARDS	
PHYS.PS1: Matter and Its Interactions	
1) Develop models to illustrate the changes in the composition of the nucleus of an atom and the energy released during the processes of fission, fusion, and radioactive decay.	**SE/TE:** 917-924, Radioactivity 925-929, Nuclear Fission 929-930, Nuclear Fusion
2) Recognize and communicate examples from everyday life that use radioactive decay processes.	**SE/TE:** 928-929, A nuclear reactor controls a fission chain reaction 930, Nuclear fusion might be a future source of energy 934-935, Radiation in Medicine 968, Miniature Nuclear Reactors
3) Investigate and evaluate the expression for calculating the percentage of a remaining atom (N(t)=N0e-λt) using simulated models, calculations, and/or graphical representations. Define the half-life (t1/2) and decay constant λ. Perform an investigation on probability and calculate half-life from acquired data (does not require use of actual radioactive samples).	**SE/TE:** 930-934, Radioactive Dating
PHYS.PS2: Motion and Stability: Forces and Interactions	
1) Investigate and evaluate the graphical and mathematical relationship (using either manual graphing or computers) of one-dimensional kinematic parameters (distance, displacement, speed, velocity, acceleration) with respect to an object's position, direction of motion, and time.	**SE/TE:** 43-46, Describing Motion 48-53, Speed and Velocity 54-57, Position-Time Graphs 58-60, Equation of Motion 76-77Acceleration can be determined graphically 86, A velocity-time graph indicates distance traveled 92-95, Position-Time Graphs for Constant Acceleration
2) Algebraically solve problems involving constant velocity and constant acceleration in one-dimension.	**SE/TE:** 73-81,Acceleration 82-90, Motion with Constant Acceleration 99, Example 3.12

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3) Algebraically solve problems involving arc length, angular velocity, and angular acceleration. Relate quantities to tangential magnitudes of translational motion.	**SE/TE:** 267-275, Describing Angular Motion
4) Use free-body diagrams to illustrate the contact and non-contact forces acting on an object. Use the diagrams in combination with graphical or component-based vector analysis and with Newton's first and second laws to predict the position of the object on which the forces act in a constant net force scenario.	**SE/TE:** 161-162, Free-body diagrams are useful in applying Newton's laws 163, Figure 5.8, The normal force is perpendicular to a surface 163, F8igure 5.9, Weight and mass 164, Example 5.7, Where's the Fire? 165, Figure 5.10, Apparent weight 166, Figure 5.12, Stretching a spring 167, figure 5.13, Tension in a string 169, Example 5.10, Find the Tension 171, Figure 5.15, The force of kinetic friction depends on the normal force 172, Example 5.11, Pass the Salt—Please 173, Figure 5.16, the maximum limit of static friction 174, Example 5.12, Stranger Than Friction 180-185, Assessment #52, 75, 84-85, 93, 111, 118 313, Figure 9.6, Gravitational force between a point mass a sphere 706, Figure 20.2, Drawing electric fields around point charges 789, Figure 22.9, The magnetic field of a current-carrying wire 793, figure 22.12, Magnetic forces between current-carrying loops
5) Gather evidence to defend the claim of Newton's first law of motion by explaining the effect that balanced forces have upon objects that are stationary or are moving at constant velocity.	**SE/TE:** 151-153, Newton's First Law

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6) Using experimental evidence and investigations, determine that Newton's second law of motion defines force as a change in momentum, $F = \Delta p/\Delta t$.	**SE/TE:** 153-156, Newton's Second Law 229-232, Momentum 235-236, An impulse changes an object's momentum
7) Plan, conduct, and analyze the results of a controlled investigation to explore the validity of Newton's second law of motion in a system subject to a net unbalanced force, $F_{net} = ma$ or $F_{net} = \Delta p/\Delta t$.	**SE/TE:** 153-156, Newton's Second Law 229-232, Momentum 235-236, An impulse changes an object's momentum
8) Use examples of forces between pairs of objects involving gravitation, electrostatic, friction, and normal forces to explain Newton's third law.	**SE/TE:** 158-159, Newton's Third Law 171, Figure 5.15, The force of kinetic friction
9) Use Newton's law of universal gravitation, $\boldsymbol{F}=G\,m1m2/\boldsymbol{r}2$, to calculate the gravitational forces, mass, or distance separating two objects with mass, given the information about the other quantities.	**SE/TE:** 307-312, Newton's Law of Universal Gravity 312, Lesson Check, #12, 14
10) Describe and mathematically determine the electrostatic interaction between electrically charged particles using Coulomb's law, $\boldsymbol{Fe}=ke\,q1q2/\boldsymbol{r}2$. Compare and contrast Coulomb's law and gravitational force, notably with respect to distance.	**SE/TE:** 683, Coulomb's law describes the electric force 685-688, Electric force is similar to gravitational force 688, Practice Problems #13-14 688, Electric forces keep most objects close to neutral 689, Lesson Check #21-24
11) Develop and apply the impulse-momentum theorem along with scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on an object during a collision (e.g., helmet, seatbelt, parachute).	**SE/TE:** 234-240, Impulse

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12) Use experimental evidence to demonstrate that air resistance is a velocity dependent drag force that leads to terminal velocity.	**SE/TE:** 97, Many situations approximate free fall 97, Figure 3.23, Free fall and air resistance 139-140, Air resistance can affect the motion of projectiles
13) Develop a model to predict the range of a two-dimensional projectile based upon its starting height, initial velocity, and angle at which it was launched.	**SE/TE:** 131-140 Projectile Motion
14) Plan and conduct an investigation to provide evidence that a constant force perpendicular to an object's motion is required for uniform circular motion (F = m v2 / r).	**SE/TE:** 307, Inquiry Lab 320, Circular motion requires constant acceleration 321, Speed and radius determine centripetal acceleration 335, Physics Lab, Centripetal force
PHYS.PS3: Energy	
1) Identify and calculate different types of energy and their transformations (thermal, kinetic, potential, including magnetic and electrical potential energies) from one form to another in a system.	**SE/TE:** 189, Inquiry Lab 202-206, Potential Energy 389-391, Heat Engine Operation 397, Adiabatic processes do not exchange thermal energy 765-769, Electric Power 828-831, Electric Generators and Motors 842, Physics Lab, Electromagnetic Induction
2) Investigate conduction, convection, and radiation as a mechanism for the transfer of thermal energy.	**SE/TE:** 354-357, Thermal Energy Transfer
3) Use the principle of energy conservation and mathematical representations to quantify the change in energy of one component of a system when the energy that flows in and out of the system and the change in energy of the other components is known.	**SE/TE:** 206-210, Conservation of energy 249-254, Analyzing Completely Inelastic Collisions 254-256, Analyzing Elastic Collisions 387, The first law of thermodynamics is a conservation law 723-724, Energy is conserved in electrical systems

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4) Assess the validity of the law of conservation of linear momentum (p=mv) by planning and constructing a controlled scientific investigation involving two objects moving in one-dimension.	**SE/TE:** 242-247, Conservation of Momentum 248-256, Collisions 257, Ballistic Pendulum
5) Construct an argument based on qualitative and quantitative evidence that relates the change in temperature of a substance to its mass and heat energy added or removed from a system.	**SE/TE:** 343-345, The Relationships between Temperature, Energy, and Heat 361, Substances change temperature at different rates 362-363, Specific heat relates heat, mass, and temperature 400-401, Thermal energy flows from hot to cold
6) Define power and solve problems involving the rate of energy production or consumption ($P = \Delta E/\Delta t$). Explain and predict changes in power consumption based on changes in energy demand or elapsed time. Investigate power consumption and power production systems in common use.	**SE/TE:** 211-215, Power 765-769, Electric Power
7) Investigate and evaluate the laws of thermodynamics and use them to describe internal energy, heat, and work.	**SE/TE:** 358-361, Thermal energy is related to work 385-391, The First Law of Thermodynamics 392-400, Thermal Process 400-406, The Second and Third Laws of Thermodynamics
8) Communicate scientific ideas to describe how forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space. Explain how energy is contained within the field and how the energy changes when the objects generating and interacting with the field change their relative positions.	**SE/TE:** 312, Gravity is a force field 705-717, The Electric Field 783-788, Magnets and Magnetic Fields 789-795, Magnetism and Electric Current 796-805, The Magnetic Force 817-827, Electricity and Magnetism 962-967, General Relativity

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9) Describe, compare, and diagrammatically represent both electric and magnetic fields. Qualitatively predict the motion of a charged particle in each type of field, but avoid situations where the two types of fields are combined in the same region of space. Restrict magnetic fields to those that are parallel or perpendicular to the path of a charged particle.	**SE/TE:** 705-706, The electric field can be visualized 713-714, Simple rules are used for drawing electric field lines 715, Electric fields have distinctive shapes and patterns 784, Magnets produce magnetic fields 789-794, Determining Magnetic Field Direction 796-805, The Magnetic Force
10) Develop a model (sketch, CAD drawing, etc.) of a resistor circuit or capacitor circuit and use it to illustrate the behavior of electrons, electrical charge, and energy transfer.	**SE/TE:** 748, AC and DC Circuits 749, A Simple DC Circuit 750, Electric current flow is *opposite* that of the electrons 752, Table 21,1 Elements of Electric Circuits 754, Figure 21.9, Simple diode circuits 758, Figure 21.15 Resistors in series 760, Figure 21.16, Resistors in Parallel 760, Figure 21.17, A short circuit 761, Example 21.6, Three Resistors 762, Figure 21.18 analyzing a complex circui8t of resistors 763, Example 21.7, Combination Special R60, Appendix C: Table C.2, Electric Circuit Symbols
11) Investigate Ohm's law (I=V/R) by conducting an experiment to determine the relationships between current and voltage, current and resistance, and voltage and resistance.	**SE/TE:** 745-750, Electric Current 750-753, Resistors 757-759, Series Circuits 759-762, Parallel Circuits 762-763, Combination Circuits 765-769, Electric Power 832-835, Alternating Current Circuits
12) Apply the law of conservation of energy and charge to assess the validity of Kirchhoff's loop and junction rules when algebraically solving problems involving multi-loop circuits.	**SE/TE:** 723-724, Energy is conserved in electrical systems

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13) Predict the energy stored by a capacitor and how charge flows among capacitors connected in series or parallel.	**SE/TE:** 728-729, A capacitor can store charge and energy 729, Practice Problems #37-38 732-733, Capacitors can store large amounts of energy
14) Recognize and communicate information about energy efficiency and/or inefficiency of machines used in everyday life.	**SE/TE:** 390, A heat engine is characterized by its efficiency 401-403, Heat Energy Efficiency
15) Compare and contrast the process, design, and performance of numerous next-generation energy sources (hydropower, wind power, solar power, geothermal power, biomass power, etc.).	**SE/TE:** 333, Tidal Energy 903, Hydrogen as Fuel 908, Miniature Nuclear Reactors 930, Nuclear fusion might be a future source of energy
PHYS.PS4: Waves and Their Applications in Technologies for Information Transfer	
1) Know wave parameters (i.e., velocity, period, amplitude, frequency, angular frequency) as well as how these quantities are defined in the cases of longitudinal and transverse waves.	**SE/TE:** 470-475, Waves and Wave Properties
2) Describe parameters of a medium that affect the propagation of a sound wave through it.	**SE/TE:** 474, Waves have different speeds in different materials 494-496, The speed of sound varies
3) Understand that the reflection, refraction, and transmission of waves at an interface between two media can be modeled on the basis of characteristics of specific wave parameters and parameters of the medium.	**SE/TE:** 476-478, Superposition and Interference 597-605, Refraction 565-569, Reflection of Light 637-646, Interference 647-653, Interference in Thin Films
4) Communicate scientific and technical information about how the principle of superposition explains the resonance and harmonic phenomena in air columns and on strings and common sound devices.	**SE/TE:** 476-478, Superposition and Interference 478-482, Standing Waves 482, Lesson Check #49-55

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5) Evaluate the characteristics of the electromagnetic spectrum by communicating the similarities and differences among the different bands. Research and determine methods and devices used to measure these characteristics.	**SE/TE:** 537-538, Electromagnetic waves are characterized by their frequencies 539-541, Electromagnetic waves have a range of properties
6) Plan and conduct controlled scientific investigations to construct explanations of light's behavior (reflection, refraction, transmission, interference) including the use of ray diagrams.	**SE/TE:** 565-569, Reflection of Light 570-573, Plane Mirrors 571, Example 16.2: Reflecting on a Flower 572, Example 16.3: How Tall Is the Mirror? 573, Example 16.4: Two-Dimensional Corner Reflection 575-585, Curved Mirrors 637-646, Interference 647-653, Interference in Thin Films
7) Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model.	**SE/TE:** 534, Light behaves like a wave and a particle 864-867, Wave –Particle Duality 867, 24.2 Lesson Check #28
8) Obtain information to construct explanations on how waves are used to produce, transmit, and capture signals and store and interpret information.	**SE/TE:** 512, The Doppler effect has many useful applications 619-622, Optical Devices
9) Investigate how information is carried in optical systems and use Snell's law to describe the properties of optical fibers.	**SE/TE:** 599-Changing the speed of light can change its direction 606-608, Light rays can become "trapped" inside a material 608, Total internal reflection has many applications