Praxis® Physics: Content Knowledge (5265)
Curriculum Crosswalk

Test Content Categories	Required Course Numbers										
I. Mechanics (32%) **A. Vectors and Scalars**											
1. Vector and scalar quantities in describing motion and forces. a. Scalars (e.g., mass, speed, time, energy) b. Vectors (e.g., displacement, velocity, acceleration, force, momentum) c. Vector components d. Addition of vectors e. Resultant vector											
B. Kinematics											
1. Motion in terms of displacement, velocity, and acceleration. **a. Linear motion** **b. Simple harmonic motion (e.g., pendulums, spring oscillation)** **c. Circular motion** **d. Projectile motion** **e. Rotational kinematics (e.g., angular displacement, angular velocity, angular acceleration)**											
2. Frames of reference and their applications. **a. Frames of reference (e.g., coordinate systems, inertial reference frames)** **b. Relative velocity**											

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C. Dynamics and Fluid Mechanics											
1. Newton's three laws of motion. **a. Newton's first law of motion (e.g., mass, inertia, inertial reference frame)** **b. Newton's second law of motion (net force, mass, acceleration)** **c. Newton's third law of motion (action-reaction forces)** **d. Applications (e.g., inclined planes, pendulums, Atwood machine)**											
2. Static equilibrium. **a. Sum of forces** **b. Sum of torques**											
3. Friction, including forces and coefficients. **a. Normal force** **b. Frictional force** **c. Coefficients of static and kinetic friction**											
4. Circular motion. **a. Centripetal acceleration** **b. Centripetal force**											

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5. Simple harmonic motion. **a. Restoring force (e.g., Hooke's law)** **b. Properties of simple harmonic motion (e.g., period, frequency, amplitude)** **c. Pendulums** **d. Spring oscillation**											
6. Work, mechanical energy, and power, and how they are related to one another. **a. Mechanical energy (e.g., kinetic energy, potential energy, conservation of energy)** **b. Work** **c. Work and energy** **d. Power** **e. Simple machines and mechanical advantage**											
7. Linear momentum and impulse and how they are related to one another. **a. Linear momentum** **b. Impulse** **c. Impulse and momentum**											
8. Rotational motion. **a. Center of mass** **b. Angular momentum** **c. Conservation of angular momentum** **d. Torque** **e. Rotational inertia (moment of inertia)**											

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9. Differences between elastic and inelastic collisions. **a. Elastic collisions** **b. Inelastic collisions** **c. Conservation of momentum** **d. Conservation of kinetic energy** **e. Collisions in one dimension** **f. Collisions in two dimensions**											
10. Laws of conservation of energy and conservation of linear momentum. **a. Conservation of energy** **b. Conservation of linear momentum** **c. Energy transformations**											
11. Newton's law of universal gravitation. **a. Newton's law of universal gravitation** **b. Satellites and orbital motion** **c. Gravitational acceleration**											
12. Difference between weight and mass. **a. Weight and mass** **b. Difference between weight and mass** **c. Relationship between density and mass**											
13. Kepler's three laws of orbital motion. **a. Kepler's first law (law of ellipses)** **b. Kepler's second law (law of equal areas)** **c. Kepler's third law (relationship between orbital**											

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period and mean orbital radius)											
14. Fluid mechanics. a. Archimedes' principle b. Bernoulli's principle c. Pascal's principle d. Properties of fluids (e.g., density, pressure, viscosity)											
II. Electricity and Magnetism (19%)											
1. Electrostatics. a. Electric charge b. Induced charge c. Coulomb's law d. Electrostatic forces e. Electric field f. Electric flux g. Electric potential h. Electric potential energy i. Potential difference j. Gauss's law											
2. Electrical properties of conductors, insulators, and semiconductors. a. Conductors b. Insulators											

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Test Content Categories	Required Course Numbers										
c. Semiconductors d. Material examples (e.g., metals, ceramics, superconductors)											
3. Electrical current, resistance, potential difference, energy, power, and the relationships between them. a. Electric current b. Potential difference c. Resistance d. Resistivity e. Ohm's law f. Energy g. Power h. Energy and power (e.g., kilowatt-hours vs. kilowatts)											
4. Capacitance and inductance. a. Capacitance and capacitors b. Inductance and inductors											
5. Differences between alternating and direct current. a. Direct current b. Alternating current											
6. How to analyze simple series, parallel, and combination circuits. a. Series circuits b. Parallel circuits c. Combination circuits d. Ohm's law e. Equivalent resistance f. Equivalent capacitance g. Kirchhoff's laws											

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Test Content Categories	Required Course Numbers										
h. Measurement devices within circuits (e.g., ammeters, voltmeters)											
7. How sources generate electric potential. a. Batteries b. Photocells c. Generators d. Electromotive force (EMF)											
8. Magnetic fields, magnetic forces, and properties of magnetic materials. a. Magnetic field b. Magnetic flux c. Magnetic force d. Magnets (e.g., bar magnets and poles, permanent magnets, electromagnets) e. Transformers, motors, and generators f. Direction of fields and forces (e.g., right-hand rule) g. Magnetic field generated by a steady current (e.g., Biot-Savart law) h. Ampere's law i. Lorentz force law (force on a moving charge) j. Force between current-carrying wires											
9. How a changing electric field produces a magnetic field and how a changing magnetic field produces an											

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Test Content Categories	Required Course Numbers										
electric field. a. Ampere's law b. Lenz's law (direction of induced current) c. Faraday's law of induction d. Motional EMF											
III. Optics and Waves (13%)											
1. Types of waves and their characteristics. a. Transverse and longitudinal b. Wave motion and propagation (mechanical vs. electromagnetic) c. Amplitude, wavelength, frequency, period, speed, energy d. Superposition and phase e. Intensity and inverse square law f. Standing waves											
2. Wave phenomena such as reflection, refraction, interference, and diffraction. a. Reflection, refraction, Snell's law, dispersion, total internal reflection b. Diffraction, interference, superposition, Young's double-slit interference experiment c. Polarization d. Scattering, absorption, transmission e. Resonance and natural frequencies, harmonics											
3. Fundamentals of the Doppler effect. a. Doppler effect b. Apparent frequency c. Moving source											

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Test Content Categories	Required Course Numbers										
d. Moving observer e. Redshift, blueshift											
4. Characteristics of sound. a. Compression waves b. Speed of sound (e.g., sonic boom, sound barrier) c. Pitch (frequency), loudness (intensity) d. Beats e. Air columns (open and closed pipes)											
5. Electromagnetic waves and the electromagnetic spectrum. a. Electromagnetic waves (e.g., electric and magnetic fields, speed of light, energy) b. Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays)											
6. Geometric optics. a. Ray tracing b. Focal point, image distance, image size and magnification, real vs. virtual image, image orientation c. Lenses (converging, diverging) d. Mirrors (plane, convex, concave, spherical, parabolic) e. Lens and mirror equations f. Simple instruments (e.g., magnifying glass, telescope, microscope) g. Prisms											

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Test Content Categories	Required Course Numbers										
IV. Heat, Energy, and Thermodynamics (12%)											
1. Temperature, temperature scales, heat, and heat capacity. **a. Temperature (measure of average kinetic energy)** **b. Temperature scales** **c. Heat and thermal energy** **d. Difference between temperature and thermal energy** **e. Heat capacity and specific heat** **f. Calorimetry** **g. Thermal expansion**											
2. Mechanisms of heat transfer. **a. Conduction** **b. Convection** **c. Radiation**											
3. Different forms of energy and transformations between them. **a. Forms of energy (e.g., kinetic, potential, mechanical, electrical, electromagnetic, chemical, nuclear)** **b. Energy transformations**											
4. Energy involved in phase transitions between the various states of matter. **a. Phase transitions**											

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Test Content Categories	Required Course Numbers										
b. Phase diagrams c. Heating/cooling diagrams d. Heats of vaporization, fusion, and sublimation											
5. Kinetic molecular theory and the ideal gas laws. a. Kinetic molecular theory (e.g., assumptions of the theory, temperature, pressure, average molecular speeds) b. Ideal gases and the ideal gas law											
6. Laws of thermodynamics. a. First law (e.g., internal energy, conservation of energy, work, heat) b. Second law (entropy) c. Third law (absolute zero) d. Zeroth law (thermal equilibrium) e. P-V diagrams f. Thermodynamic processes (e.g., isothermal, adiabatic, reversible/irreversible) g. Heat engines and efficiency (e.g., ideal vs. actual efficiency, temperature differences)											
V. Modern Physics, and Atomic and Nuclear Structure (12%)											
1. Organization, structure and states of matter. a. Atoms, molecules, ions b. Solids, liquids, gases, plasmas c. Chemical/physical properties and changes											
2. Nature of atomic and subatomic structure including											

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various models of the atom. a. Atomic and subatomic structure (e.g., electrons, protons, neutrons, and isotopes) b. Models of the atom (e.g., Bohr model, quantum model) c. Experimental basis of models (e.g., Rutherford experiment, Millikan oil-drop experiment, Thomson experiment)											
3. Relationship of atomic spectra to electron energy levels. a. Electron energy transitions in atoms b. Absorption and emission spectra											
4. Characteristics, processes, and effects of radioactivity. a. Radioactivity and radioactive decay processes b. Alpha particles, beta particles, and gamma radiation c. Half-life d. Radioisotopes e. Fission and fusion											
5. Topics in modern physics. a. Wave-particle duality b. Photoelectric effect c. Special relativity d. Heisenberg uncertainty principle e. de Broglie's hypothesis f. Nuclear forces (strong and weak) and binding											

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energy											
VI. Scientific Inquiry, Processes, and Social Perspectives (12%) **A. History and Nature of Scientific Inquiry**											
1. Processes involved in scientific inquiry. **a. Identifying problems** **b. Forming and testing hypotheses** **c. Development of theories, models, and laws** **d. Process skills, including observing, comparing, inferring, categorizing, generalizing, and concluding**											
2. Experimental design. **a. Experimental procedures used to test hypotheses** **b. Reproducible procedures** **c. Significance of controls** **d. Dependent and independent variables** **e. Determining what data need to be collected**											
3. Nature of scientific knowledge. **a. Is subject to change** **b. Is consistent with evidence** **c. Is based on reproducible evidence** **d. Includes unifying concepts and processes (e.g.,**											

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Test Content Categories	Required Course Numbers										
systems, models, constancy and change, equilibrium, form and function)											
4. How major principles in physics developed historically and the contributions of major historical figures. **a. How current principles and models developed over time** **b. Major developments (e.g., atomic model, Newtonian mechanics, Rutherford experiment)** **c. Major historical figures in the development of physics**											
B. Scientific Procedures and Techniques											

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1. How to collect, process, analyze, and report data including sources of error. **a. Organization and presentation of data** **b. Units of measurement including SI, SI derived, and others (e.g., meter, newton, mile)** **c. Unit conversion and dimensional analysis** **d. Scientific notation and significant figures** **e. Measurement equipment, including applications** **f. Basic error analysis, including precision and accuracy** **g. Identifying sources of error** **h. Interpreting and drawing valid conclusions from data presented in tables, graphs, and charts (e.g., trends in data, relationships between variables, predictions based on data)**											
2. Appropriate use of materials, equipment, and technology in the high school physics laboratory and classroom. **a. Appropriate use and storage** **b. Appropriate prelab setup and classroom demonstrations** **c. Safety procedures and precautions**											

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C. Science, Technology, and Society											
1. Impact of physics and technology on society and the environment. a. Space exploration, communications, etc. b. Climate change, ozone layer depletion, noise pollution, etc. c. Production, storage, and disposal issues associated with consumer products											
2. Major issues associated with energy use and production. a. Renewable and nonrenewable energy resources b. Conservation and recycling c. Power generation based on various sources, such as fossil and nuclear fuel, hydropower, wind power, solar power, and geothermal power d. Storage and distribution of renewable energy (e.g., alternative fuels, fuel cells, rechargeable batteries)											
3. Applications of physics in daily life. a. Communications (e.g., wireless devices, fiber optics, satellites) b. Research tools (e.g., space telescopes, lasers, super colliders) c. Medicine (e.g., medical imaging, lasers) d. Transportation (e.g., superconductors, magnetic levitation) e. Other applications											