Learning Objectives for AP Physics "B:

This compact checklist shows how the Fizix-Power Software is aligned with the "College Board Learning Objectives for AP Physics" (apcentral.collegeboard.com.)

	Section1 Newtonian Mechanics (35%)	
A.	**Kinematics and Motions in 1D and 2D (7%)**	
1.	In 1D - Distance /Displacement, speed/velocity, acceleration, 4 EQ's of Motion, graphs, coordinate systems, free fall	Kinematics.mmf
2.	In 2D - Vector Components, vector math, relative displacement and velocity, projectile motion, graphs	Vector Application, projectile.mmf, relative_velocity.mmf
B.	**Newton's Laws of Motion (9%)**	
1.	1st Law - Object at rest stays at rest …, Constant velocity, static equilibrium	
2.	2nd Law - F = ma, calculate v, free body diagrams, net forces, friction, terminal velocity	Newton.mmf, non_inertial.mmf, motion_friction.mmf, coupled_motion.mmf
3.	3rd Law - Equal and Opposite, force pairs, multi-mass systems, simultaneous equations	var_mass.mmf
C.	**Work, Energy, Power (5%)**	
1.	Work-Energy Theorem – Definition of work, pos/neg, work over, x, area of graph, KE	energy.mmf
2.	Forces and Potential Energy – Conservative forces, with springs and gravitational fields	energy.mmf
3.	Conservation of Energy – Converting forms when mechanical is not conserved, systems of objects, total energy	energy.mmf
4	Power – Calculate power for acceleration or mechanical motion, work performed by forces, average power, rate	energy.mmf
D.	**Systems of Particles and Linear Momentum (4%)**	
1.	Impulse and Momentum – Total momentum of system, p, area of F vs. t graph	impulse.mmf
2.	Conservation and Momentum – Collisions inelastic (in 1D & 2D), elastic (1D), systems w/springs "explosions"	collision_1D.mmf, collision_2D.mmf
3.	Center of Mass – (calculations not on AP physics B)	Center of Mass Application
E.	**Circular Motion and Rotation (4%)**	
1.	Uniform Circular Motion – Circular and tangential vectors, centripetal acceleration, motions w/ horizontal and vertical circles	circular_motion.mmf
2.	Torque and Rotational Statics – Magnitude and direction, conditions of translational and rotational equilibrium	angular.mmf
3.	Rotational Kinematics and Dynamics , Angular Momentum and Conservation – (not in AP Physics B)	angular.mmf
F.	**Oscillations and Gravitation (6%)**	
1.	Simple Harmonic Motion – Asin (wt), graphs, max/min/zero for disp/velocity/accel, KE+PE along motion	SHM.mmf
2.	Mass on a Spring – Vertical and horizontal spring systems, factors in equation for period	SHM.mmf
3.	Pendulum and other Oscillations – State approximations, factors in equation for period	SHM.mmf
4.	Newton's Law of gravity – Force between two spherical masses, strength of gravitational field	gravity_orbits.mmf
5.	Orbits – Factors of motion, Kepler's 3rd. law	gravity_orbits.mmf
	Section II Fluid Mechanics and Thermal Physics (15%)	
G.	**Fluid Mechanics (6%)**	
1.	Hydrostatic Pressure – Pressure, force, area, in fluids, on containers, gauge pressure, as function of depth	Manometer Application
2.	Buoyancy – Immersed objects total/partial, Archimedes's principle, buoyant forces, apparent weight, density	buoyancy.mmf
3.	Fluid Flow Continuity – Equation of continuity for fluids in motion	bernoulli.mmf
4.	Bernoulli's Equation - Bernoulli's equations for fluids in motion	bernoulli.mmf
H.	**Temperature and Heat (2%)**	
1.	Mechanical Equivalent of Heat – Heat produced by mechanical work	
2.	Heat transfer and Thermal Expansion – Factors of heat flow, thermal expansion, conduction/convection/radiation	Mixture Application
I.	**Kinetic Theory and Thermodynamics (7%)**	
1a.	Ideal Gases Assumptions, KE & Avg velocity, PV= nRT, pressure and collisions, proportional to temp, U	gas_law.mmf
1b.	Isobaric, isometric, isothermic, adiabatic expansion/compression, relation to PV diagrams	gas_law.mmf
2a.	1st law of Thermodynamics – Work done on/by system, cyclic processes, work as area enclosed in PV diagrams	first_law_thermo.mmf
2b.	2nd. law of Thermodynamics – Entropy, max/actual efficiency of engine, heat exchange, Carnot cycle	Carnot Cycle Application, gas_diesel_engine.mmf, efficiency.mmf

	Section III – Electricity and Magnetism (25%)	
J.	**Electrostatics (5%)**	
1.	Charge and Coulomb's Law – Induced and polarized charges, direction of forces on charges and their motions	Point and Distributed Charges Applications
2.	Electric Fields and Potential – test and point charges, fields, diagrams, electric potential and difference, work required	Point and Distributed Charges Applications
3.	Gauss's Law, and Fields and Potentials for Other Charge Distributions (not on AP Physics B)	Gauss Theorem and Superposition Applications
K.	**Conductors, Capacitors and Dielectrics (4%)**	
1.	Electrostatics w/Conductors – Fields inside and on surface, equipotentials & diagrams, induction, "neutral attraction"	Spherical Shells Application
2.	Capacitors – Voltage, charge, stored energy and converting, electric field & strength inside, factors of capacitance	capacitor.mmf
3.	Dielectrics – (not on AP Physics B)	Dielectric Application
L.	**Electric Circuits (7%)**	
1.	Current, Resistance & Power – Current direction, Ohm's Law, drift velocity, factors of resistance, heat	Resistors Application
2a.	DC Circuits – Batteries, resistors in series/parallel, voltage/current in circuit and ratios, equivalent circuits	Resistors Application
2b.	DC Circuits – Power terminal voltage, emf and internal resistance, connecting voltmeters/ammeters	Resistors Application
3.	Capacitors in Circuits – In series/parallel, equivalent circuits, voltage in steady state	Capacitors Application
4.	Kirchoff's Rules for Circuits with 2 or more Unknown currents, and RC Circuits (not in AP Physics B)_	RC Circuits Application
M.	**Magnetic Fields (4%)**	
1.	Forces on Moving Charges – Direction, work in field, path of particles circular/perpendicular & their velocity	Mag. Field Application
2.	Forces on Current carrying Wires – Direction, straight segments, on loops and their rotation	Mag. Force Application
3..	Forces on Long Current Carrying Wires – For points near, direction, attract/repel of two long wires	Mag. Force Application
4.	Biot-Savart Law and Ampere's Law – (not on AP Physics B)	Mag. Force Application
N.	**Electromagnetism (5%)**	
1.	Electromagnetic Induction – Faraday's Law, Lenz's Law, flux, w/loops & changing fields/areas, induced emf/current	Electro-Magnetic Induction Application
2.	Inductance, LR and LC Circuits, Maxwell's Equations not on AP Physics B)	
	Section IV – Waves and Optics (15%)	
O.	**Wave Motion, Including Sound (5%)**	
1.	Travelling Waves – Graphs, amplitude, wavelength, freq, period, Doppler Effect, factors of velocity, v=f--	wave_motion.mmf, Doppler Application
2.	Wave Propagation – Transverse, longitudinal, polarization, intensity, power, inverse-square law	wave_motion.mmf
3.	Standing Waves – Systems of open/open, closed/closed, open/closed, wavelengths, possible harmonics, nodes	organ_pipe.mmf
4.	Superposition – Waves moving in opposite directions, constructive/destructive interference, at loose/fixed ends	string.mmf
P.	**Physical Optics (5%)**	
1a.	Interference – From 2 sources, factors of maxima/minima locations, intensity pattern from 1+ source	two_slit.mmf
1b.	Diffraction – Diffraction gratings & advantages, thin films and phases, Newton's rings	thin_film.mmf
2.	Dispersion of Light – Relate freq, L & indices to refraction, areas/names of EM spectrum & properties	refraction.mmf
Q.	**Geometric Optics (5%)**	
1.	Reflection and Refraction – Velocity, freq & L when changing mediums	refraction.mmf
2.	Mirrors – Plane & spherical, ray tracing & types of images, focal point, center of curvature, mirror equation	Lens Application
3.	Lenses - Converging & diverging, changing index/medium/curvature, multiple lenses, ray tracing, lens equation	Mirror Application
	Section V – Atomic and Nuclear Physics (10%)	
R.	**Atomic and Quantum Effects (7%)**	
1a.	Photons – Energy in J & eV, momentum and emission/absorption/reflection, relate # photons, L & power	
1b.	Photoelectric Effect – Experiment for & implications, KE vs L & intensity, stopping potential vs freq,	
1c.	Compton – Experiment & implications, scattering, effect, wavelength, production of x-rays & min L	
2.	Atomic Energy Levels – Gas spectra, calculate L and energy of transition levels, transition diagrams	
3.	Wave-Particle Duality – Cases for both, de Broglie L vs momentum, Davisson-Germer experiment	
S.	**Nuclear Physics (3%)**	
1.	Nuclear Reactions – Symbols, conservation mass & charge, types of decay, fission, nuclear force, chain reactions	
2.	Mass-Energy Equivalence – Energy released in nuclear processes, -E – (-m)c2	