Science
Physics: Honors
Unit 3: Newton's Laws of Motion

Essential Understandings	▪ Conceptual: o The reoccurring fundamental principles elaborated in physics have uses and implications in every dimension of modern life. o Physics seeks to analyze and understand every system as a demonstration of the cause-effect relationship. ▪ Computational: o Physics quantifies each variable of a system in order to describe, analyze and understand it. o A variety of problem solving techniques make use of a system's quantities to investigate the conceptual relationships evidenced within the system. o Numerical problem solving is an essential component in developing a clear understanding of the conceptual relationships identified within any system.
Essential Questions	▪ What is the difference between weight and mass? ▪ How does a net force affect the motion of an object? ▪ In what way does inertia impact the movement of an object? ▪ How is apparent weight different from weight? ▪ What is the difference between Static and kinetic friction?
Essential Knowledge	▪ Forces act in equal and opposite pairs. ▪ Normal forces act perpendicular to the surface. ▪ Frictional forces act parallel to surfaces. ▪ Weight is the gravitational force on an object. ▪ The sum of the forces equals the mass of an object times the acceleration experienced by that object. ▪ Acceleration is zero when in Translational Equilibrium. ▪ Acceleration is always in the direction of the net force. ▪ Hooke's Law explains the force and the displacement of springs.
Vocabulary	▪ Terms: o inertia, mass, free body diagram, normal force, friction, apparent weight, kinetic friction, static friction, coefficient of friction, spring constant (k), Translational Equilibrium, centripetal acceleration
Essential Skills	▪ Draw Free Body Diagrams. ▪ Analyze systems of forces. ▪ Calculate acceleration in orthogonal directions. ▪ Compute frictional forces between objects. ▪ Analyze systems of connected objects. ▪ Use centripetal acceleration to calculate circular velocity.

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Related Maine Learning Results	Science and Technology A. Unifying Themes A1.Systems Students apply an understanding of systems to explain and analyze man-made and natural phenomena. a. Analyze a system using the principles of boundaries, subsystems, inputs, outputs, feedback, or the system's relation to other systems and design solutions to a system problem. A2.Models Students evaluate the effectiveness of a model by comparing its predictions to actual observations from the physical setting, the living environment, and the technological world. A3.Constancy and Change Students identify and analyze examples of constancy and change that result from varying types and rates of change in physical, biological, and technological systems with and without counterbalances. C. The Scientific and Technological Enterprises C2.Understandings About Science and Technology Students explain how the relationship between scientific inquiry and technological design influences the advancement of ideas, products, and systems. a. Provide an example that shows how science advances with the introduction of new technologies and how solving technological problems often impacts new scientific knowledge. b. Provide examples of how creativity, imagination, and a good knowledge base are required to advance scientific ideas and technological design. c. Provide examples that illustrate how technological solutions to problems sometimes lead to new problems or new fields of inquiry.

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Related Maine Learning Results	D. The Physical Setting D4. Force and Motion Students understand that the laws of force and motion are the same across the universe. a. Describe the contribution of Newton to our understanding of force and motion, and give examples of and apply Newton's three laws of motion and his theory of gravitation. b. Explain and apply the ideas of relative motion and frame of reference. c. Describe the relationship between electric and magnetic fields and forces, and give examples of how this relationship is used in modern technologies. d. Describe and apply characteristics of waves including wavelength, frequency, and amplitude. e. Describe and apply an understanding of how waves interact with other waves, and with materials including reflection, refraction, and absorption. f. Describe kinetic energy (the energy of motion), potential energy (dependent on relative position), and energy contained by a field (including electromagnetic waves) and apply these understandings to energy problems.
Sample Lessons And Activities	▪ Actively read the text book completing the examples presented ▪ Individually answer conceptual questions and solve problems ▪ Collectively discuss the answers and solutions in class ▪ Discuss real world examples of concepts presented in the textbook and encountered in the real world ▪ Centripetal Force Lab ▪ Atwood Machine Lab with Pasco sensors
Sample Classroom Assessment Methods	▪ Homework assignments. ▪ Assess understanding in classroom discussions. ▪ Free Body Diagram quiz ▪ Written formative and summative assessments with real world conceptual questions and numerical problems
Sample Resources	▪ Publications: o Physics, second edition - James S. Walker ▪ Videos: o Mechanical Universe Video Series ▪ Other Resource: o Companion Website: http://physics.prenhall.com/walker o Physics Demonstrations in Mechanics o The University of Maine Tutorials 8-10