Science
Geophysical Science
Unit 3: Forces

Essential Understandings	▪ Causation: Nothing "just happens". Everything is caused. ▪ Interrelatedness: Everything in the universe is connected to everything else in the universe. ▪ Dynamism: Everything is changing in some way all the time. ▪ Entropy: Change has direction. Generally, simple precedes complex. Generally, order changes toward disorder. ▪ Uniformitarianism: The way the universe works today is the way it worked yesterday and the way it will work tomorrow.
Essential Questions	▪ What is a force? ▪ How are balanced and unbalanced forces different? ▪ What causes acceleration? ▪ How are acceleration, mass and force related? ▪ Why are forces increasingly described as interactions? ▪ What conditions are required to attain terminal velocity? ▪ How are momentum and inertia related? ▪ What factors affect the distance a projectile will travel?
Essential Knowledge	▪ $a = F / m$ ▪ Mathematical relationships may be inverse or direct. ▪ Net forces cause acceleration. ▪ Forces exist in pairs. ▪ Weight is the measure of the force of gravity on an object. ▪ Air resistance is dependent upon the characteristics of the air, the object and the interaction between them. ▪ $p = m v$ ▪ Vertical and horizontal velocities of projectiles are independent.
Vocabulary	▪ Terms: ○ force, net force, friction, gravity, weight, newtons (N), balanced forces, terminal velocity, air resistance, momentum, projectile
Essential Skills	▪ Use mathematics to calculate acceleration, force and mass. ▪ Analyze systems to realize the relationships among force, mass, and acceleration.
Related Maine Learning Results	Science and Technology A. Unifying Themes 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.

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Related Maine Learning Results	B. The Skills and Traits of Scientific Inquiry and Technological Design B1.The Skills and Traits of Scientific Inquiry Students methodically plan, conduct, analyze data from, and communicate results of in-depth scientific investigations, including experiments guided by a testable hypothesis. a. Identify questions, concepts, and testable hypotheses that guide scientific investigations. b. Design and safely conduct methodical scientific investigations, including experiments with controls. c. Use statistics to summarize, describe, analyze, and interpret results. d. Formulate and revise scientific investigations using logic and evidence. e. Use a variety of tools and technologies to improve investigations and communications. f. Recognize and analyze alternative explanations and models using scientific criteria. g. Communicate and defend scientific ideas. 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	▪ Constant Force / Changing Mass Laboratory ▪ Constant Mass / Changing Force Laboratory ▪ Balloon Rockets ▪ Shooting the falling monkey.

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Sample Classroom Assessment Methods	▪ Chapter Tests ▪ Motion Quizzes ▪ Laboratory Reports ▪ Sharing Circles (or rectangles, or other geometries)
Sample Resources	▪ Publications: o Glencoe Physical Science o MARVEL Data bases * o GALE Resource Data bases ** ▪ Videos: o The Mechanical Universe o ESPN Sports Figures