

Science
Unit 4: Force, Motion and Waves

Essential Understandings	<ul style="list-style-type: none"> ▪ Objects move according to generally accepted laws of motion. ▪ Various scientists have contributed to the field of physics throughout history. ▪ Energy cannot be created nor destroyed but can be transferred or converted into different forms. ▪ Energy is the ability to do work. ▪ Energy travels in many different ways, including waves. ▪ Many different forces can affect the motion of objects. ▪ All matter exerts gravitational force.
Essential Questions	<ul style="list-style-type: none"> ▪ Why do objects move the way they do in relation to each other? ▪ How do different kinds of energy travel? ▪ What are the two types of wave motion? ▪ What are the similarities and differences between sound, light, and heat? ▪ How do different media affect the transfer of energy? ▪ What are the properties of waves? ▪ What is radiation? ▪ How does heat travel in conduction and convection? ▪ What is the electromagnetic spectrum? ▪ How do forces change motion? ▪ How does gravity affect objects?
Essential Knowledge	<ul style="list-style-type: none"> ▪ Various scientists contributed to the field of physics throughout history. ▪ Sir Isaac Newton's Laws of Motion and Gravity can be used to describe the motion of objects. ▪ Heat travels in different ways: conduction, convection, and radiation. ▪ There are two types of wave motion: transverse and longitudinal. ▪ Waves are different depending on their wavelength and frequency. ▪ Energy put into and out of a system can change the motion of particles in matter. ▪ Energy travels at different speeds depending on the medium. ▪ Energy travels in all directions. ▪ Gravitational force depends on mass and on distance between objects. ▪ Force is any push or pull. ▪ Forces can combine.
Vocabulary	<ul style="list-style-type: none"> ▪ <u>Terms:</u> <ul style="list-style-type: none"> ○ inertia, motion, acceleration, force, gravity, velocity, speed, momentum, mass, weight, action and reaction, longitudinal, transverse, electromagnetic spectrum, wavelength, amplitude, frequency, crest, trough, radiation, convection, conduction, reflection, refraction, absorption, compression, rarefaction, potential and kinetic energy, Law of Conservation of Energy, friction, balanced and unbalanced

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	forces
Essential Skills	<ul style="list-style-type: none"> ▪ Provide examples of types of motion or interaction between objects that illustrate each of Newton's Laws. ▪ Compare and contrast different wave energies. ▪ Diagram and label the parts of a wave. ▪ Demonstrate energy being transferred or converted but not destroyed or created. ▪ Draw a force diagram and use it to decide the outcome of several forces acting on an object. ▪ Describe how gravity accelerates all objects equally on Earth, even when it doesn't look like it. ▪ Differentiate between sound, light, and heat energies.
Related Maine Learning Results	<p><u>Science</u></p> <p>A. Unifying Themes</p> <p>A1. Systems</p> <p>Students apply the principles of systems, models, constancy and change, and scale in science and technology.</p> <p>b. Explain how the output of one part of a system, including waste products from manufacturing or organisms, can become the input of another part of a system.</p> <p>C. The Scientific and Technological Enterprise</p> <p>C3. Science, Technology, and Society</p> <p>Students identify and describe the role of science and technology in addressing personal and societal changes.</p> <p>c. Identify factors that influence the development and use of science and technology.</p> <p>C4. History and Nature of Science</p> <p>Students describe historical examples that illustrate how science advances knowledge through the scientists involved and through the ways scientists think about their work and others.</p> <p>b. Describe a breakthrough from the history of science that contributes to our current understanding of science.</p>

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<p style="text-align: center;">Related Maine Learning Results</p>	<p>D. The Physical Setting</p> <p>D2.Earth Students describe the various cycles, physical and biological forces and process, position in space, energy transformations, and human actions that affect the short-term and long-term changes to the Earth.</p> <p>e. Describe the effect of gravity on objects on Earth.</p> <p>D3.Matter and Energy Students describe physical and chemical properties of matter, interactions and changes in matter, and transfer of energy through matter.</p> <p>h. Describe several different types of energy forms including heat energy, chemical energy, and mechanical energy.</p> <p>i. Use examples of energy transformations from one form to another to explain that energy cannot be created or destroyed.</p> <p>j. Describe how heat is transferred from one object to another by conduction, convection, and/or radiation.</p> <p>D4.Force and Motion Students describe the force of gravity, the motion of objects, the properties of waves, and the wavelike property of energy in light waves.</p> <p>a. Describe the similarities and differences in the motion of sound vibrations, earthquakes, and light waves.</p> <p>c. Describe and apply an understanding of how the gravitational force between any two objects would change if their mass or the distance between them changed</p> <p>e. Describe and apply an understanding of the effects of multiple forces on an object and how unbalanced forces will cause changes in the speed or direction.</p> <p>E. The Living Environment</p> <p>E2.Ecosystems Students examine how the characteristics of the physical, non-living (abiotic) environment, the types and behaviors of living (biotic) organisms, and the flow of matter and energy affect organisms and the ecosystem of which they are part.</p> <p>d. Describe how matter and energy change from one form to another in living things and in the physical environment.</p>
<p style="text-align: center;">Sample Lessons And Activities</p>	<ul style="list-style-type: none"> ▪ Research various scientists and their contributions to physics ▪ Use an electromagnetic spectrum chart ▪ Energy Skate Park ▪ Winter Olympics Videos (lessons attached)

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Sample Classroom Assessment Methods	<ul style="list-style-type: none"> ▪ Newton's Laws project ▪ Film Can Rocket Lab Report ▪ Quizzes
Sample Resources	<ul style="list-style-type: none"> ▪ <u>Publications:</u> <ul style="list-style-type: none"> ○ http://www.exploratorium.edu/ronh/weight/ ○ http://www.ic.arizona.edu/~nats101/n2.html ○ http://teachertech.rice.edu/Participants/louviere/Newton/law1.html ○ http://phet.colorado.edu ○ MSSV volunteer presentations ▪ <u>Videos:</u> <ul style="list-style-type: none"> ○ YouTube clips ○ Winter Olympic videos ○ www.nsf.gov/news/special_reports/olympics/