



## Physics Curriculum Bundle #6

Title	 	Suggested Dates
Conservation of Momentum		12/06-12/17 (10 Days)

Big Idea/Enduring Understanding	Guiding Questions
In the absence of external forces, momentum is conserved in interactions between objects.	How can we predict the behavior of interacting bodies?

The resources included here provide teaching examples and/or meaningful learning experiences to address the District Curriculum. In order to address the TEKS to the proper depth and complexity, teachers are encouraged to use resources to the degree that they are congruent with the TEKS and research-based best practices. Teaching using only the suggested resources does not guarantee student mastery of all standards. Teachers must use professional judgment to select among these and/or other resources to teach the district curriculum.

Knowledge & Skills with Student Expectations	Specificity & Examples	Suggested Resources (Read the note above)
<p><b>Phy.6 Science concepts. The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to:</b></p> <p><b>6D</b> demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension;</p>	<p>Understand the concept of momentum.</p> <p><i>a. Define and calculate momentum and impulse. Clearly indicate how momentum is a vector.</i></p> <p><i>b. State the conditions under which momentum is conserved.</i></p> <p><i>c. Describe the term “impulse” in terms of force, time, and momentum. Illustrate the principle of impulse by citing several examples.</i></p> <p><i>d. Solve problems using impulse and the conservation of momentum. CCRS</i></p> <p>Understand conservation of energy.</p> <p><i>a. Describe the conversion of potential energy into kinetic energy (and vice-versa) in closed systems for which only conservative forces are present.</i></p> <p><i>b. Describe the conversion of energy in systems in which dissipative forces are present.</i></p> <p><i>c. Describe the general conservation of energy. CCRS</i></p> <p style="color: red;"><b>Including</b></p> <ul style="list-style-type: none"> <li style="color: red;">• Equate impulse to the change in momentum</li> </ul>	<p>Impulse-momentum Theory Lab – compare change in momentum from motion detector with impulse from force sensor. (phys_5_ImpMom)</p> <p>Collisions Lab – cart collision with photogates for elastic &amp; inelastic collisions. (phys_5_Collisions)</p> <p>Momentum simulations – <a href="http://www.glenbrook.k12.il.us/gbssci/Phys/mmedia/index.html#momentum">http://www.glenbrook.k12.il.us/gbssci/Phys/mmedia/index.html#momentum</a></p> <p>Suggested Equipment – cart &amp; ramp, photogates, motion detector, “exploding” carts.</p>

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	<ul style="list-style-type: none"> <li>• Appreciate the importance of impulse and momentum in daily situations             <ul style="list-style-type: none"> <li>○ Protection in car accidents                 <ul style="list-style-type: none"> <li>▪ Seat belts</li> <li>▪ Air bags</li> <li>▪ Crumple zones</li> <li>▪ Collapsible barriers</li> </ul> </li> <li>○ Sports                 <ul style="list-style-type: none"> <li>▪ Collisions in football</li> <li>▪ Collisions in auto racing</li> <li>▪ Baseball</li> <li>▪ Tennis</li> </ul> </li> </ul> </li> <li>• Solve problems involving impulse and change of momentum.</li> <li>• Explain the law of conservation of momentum.</li> <li>• Solve problems involving the law of conservation of momentum.</li> <li>• Observe the law of conservation of momentum in elastic and inelastic collisions             <ul style="list-style-type: none"> <li>Such as:                 <ul style="list-style-type: none"> <li>○ Explosions</li> <li>○ Collisions between carts</li> </ul> </li> </ul> </li> </ul> <p>Pre-AP: Conservation of momentum in 2 dimensional collisions</p>	
<p><b>1 The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom.</b></p> <p><b>1A</b> demonstrate safe practices during laboratory and field investigations</p>		
<p><b>1 The student conducts investigations, for at least</b></p>		

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<p><b>40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom.</b></p> <p><b>1B</b> demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2A</b> know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2B</b> know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2C</b> know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to</p>		

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change as new areas of science and new technologies are developed;		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2D</b> distinguish between scientific hypotheses and scientific theories</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2E</b> design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2F</b> demonstrate the use of course apparatus, equipment, techniques, and procedures, including, triple beam balances, clamps, dynamics demonstration equipment, collision apparatus, slotted and hooked lab masses, power supply, stopwatches, trajectory apparatus, carbon paper, graph paper, protractors, metric rulers, meter sticks, scientific calculators, graphing technology, computers, ballistic carts or equivalent, spools of nylon thread or string.</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2G</b> use a wide variety of additional course apparatus, equipment, techniques, materials, and procedures as</p>		

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<p>appropriate such as ripple tank with wave generator, wave motion rope, micrometer, caliper, radiation monitor, computer, ballistic pendulum, electroscope, inclined plane, optics bench, optics kit, pulley with table clamp, resonance tube, ring stand screen, four inch ring, stroboscope, graduated cylinders, and ticker timer;</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2H</b> make measurements with accuracy and precision and record data using scientific notation and International System (SI) units;</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2I</b> identify and quantify causes and effects of uncertainties in measured data;</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2J</b> organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs;</p>		
<p><b>2 The student uses a systematic approach to answer scientific laboratory and field investigative questions.</b></p> <p><b>2K</b> communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports;</p>		
<p><b>2 The student uses a systematic approach to</b></p>		

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<p><b>answer scientific laboratory and field investigative questions.</b></p> <p><b>2L</b> express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations.</p>		
<p><b>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</b></p> <p><b>3A</b> in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student</p>		
<p><b>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</b></p> <p><b>3B</b> communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials</p>		
<p><b>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</b></p> <p><b>3C</b> draw inferences based on data related to promotional materials for products and services</p>		
<p><b>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</b></p> <p><b>3D</b> explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society</p>		

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<p><b>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</b></p> <p><b>3E</b> research and describe the connections between physics and future careers</p>		
<p><b>3 The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom.</b></p> <p><b>3F</b> express and interpret relationships symbolically in accordance with accepted theories to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition</p>		