

Key Physics Concepts	
Section Summaries	Physics Principles
<p><b>Section 1 Accidents</b></p> <p>Students identify and evaluate safety features in automobiles. Students then consider what safety features they could use for various vehicles and for their design of a safety system.</p>	<p>Identifying criteria for building a safety feature</p>
<p><b>Section 2 Newton's First Law of Motion: Life and Death before and after Seat Belts</b></p> <p>Students explain what occurs to passengers during a collision using Newton's first law. They read about the concept of pressure and apply this concept while designing and testing a seat belt to safely secure a clay passenger in a cart undergoing a collision.</p>	<p>Newton's first law Pressure</p>
<p><b>Section 3 Energy and Work: Why Air Bags?</b></p> <p>Students investigate and observe how spreading the force of an impact over a greater distance reduces the amount of damage done to an egg during a collision. They describe and explain their observations using the work-energy theorem.</p>	<p>Average velocity Newton's second law Work Kinetic energy Work-energy theorem</p>
<p><b>Section 4 Newton's Second Law of Motion: The Rear-End Collision</b></p> <p>Students explore the effects of rear-end collisions on passengers, focusing on whiplash. They use Newton's laws to describe how whiplash occurs. They also describe, analyze, and explain situations involving collisions using Newton's first and second laws.</p>	<p>Newton's first law Newton's second law</p>
<p><b>Section 5 Momentum: Concentrating on Collisions</b></p> <p>After observing various collisions, students are introduced to the concept of momentum. Through measurements taken during various collisions, they determine the mass of a cart. Students then calculate and consider the momentum of various objects.</p>	<p>Linear motion Momentum</p>
<p><b>Section 6 Conservation of Momentum</b></p> <p>Students investigate the law of conservation of momentum by measuring the masses and velocities of objects before and after collisions. Students then analyze various collisions by applying the law of conservation of momentum.</p>	<p>Newton's second law Newton's third law Momentum Law of conservation of momentum</p>
<p><b>Section 7 Impulse and Changes in Momentum: Crumple Zone</b></p> <p>Students design a device on the outside of a cart to absorb energy during a collision to assist in reducing the net force acting on passengers inside the vehicle. Students use probes to measure the velocity of the vehicle and the force acting on the vehicle during impact, and then describe the relationship between impulse (<math>F\Delta t</math>) and change in momentum (<math>m\Delta v</math>).</p>	<p>Newton's second law Impulse Momentum Work-energy theorem</p>