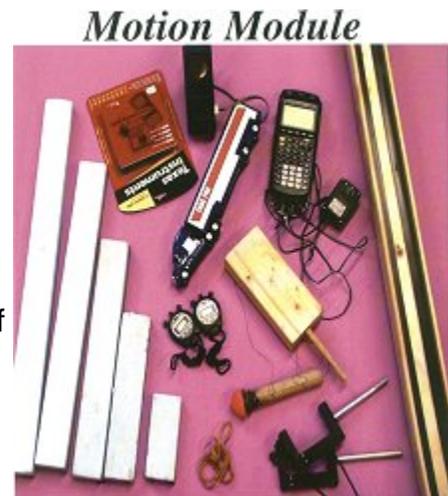


Motion and the Transportation Engineer - Physics

This module covers the topics of momentum and energy conservation that are normally taught in a high school physics course or an intermediate school physical science course. Transportation topics include automobile collision analysis, roadside crash barriers, and truck runaway crash attenuator design. Specific relationships to the National Science Education Standards (NSES) pertaining to momentum, energy, Newton's laws of motion, and scientific inquiry skills are outlined in the individual activities.



	Estimated Classroom Time	Module Contents
Activity 1	20 minutes prep, 40 minutes class time	<p>Note:* There are four versions of this module. Two of the versions have a Graphic TI-83 Calculator</p> <p>Basic Module:</p> <ul style="list-style-type: none"> Impulse Pendulum Motion Detector Photogates Stop Watches Ring Stand CBL Lab Pro Maglev Cars w/ Magnet <p>Option 1: TI-84 Calculator Option 2: 8' Maglev Track Option 3: 8' Maglev Track and TI-84 Calculator</p>
Activity 2	20 minutes prep, 40 minutes class time	
Activity 3	20 minutes prep, 40 minutes class time	
Impulse Activity	20 minutes for 1 Lab Station plus 5 minutes for each additional lab station, two 50-minute periods	

The module is divided into two sections, Momentum and Impulse. Each includes lecture demonstrations and hands-on laboratory exercises structured for students to work in small groups. Several activities may be presented as a contest between groups. The module contains seven activities from which a teacher may choose all, some, or none.

Momentum provides students the opportunity to investigate momentum in relation to traffic collisions. Included in this section are a demonstration activity and three hands-on laboratory activities.

Conservation of Momentum Using Maglev Cars, the demonstration activity, illustrates the conservation of momentum as two Maglev cars collide.

Bump-N-Run challenges students to analyze car collisions using the Maglev cars as they learn to estimate the result of collisions between cars of equal and unequal masses.

In **Calculated Collisions**, students learn to compute the conservation of energy using the Maglev cars.

In **Design Your Own TMS**, students use graphing calculators, calculator-based lab equipment, and motion detectors to create their own system for measuring speed.

Impulse includes two demonstration activities to illustrate the effect distance has on the force applied to a car on impact. **Egg Catch** offers a messy, but effective, example of the influence distance has on decreasing the force acting on the egg as it is thrown into a suspended sheet.

Impulse Pendulum demonstrates the influence direction has on the impulse in a collision. Laboratory activities provide students opportunities to apply concepts learned in the demonstrations.

In the laboratory activity **Stop That Truck!**, students investigate various barrier components to find the optimum materials to stop a ball rolling down a plane.

Troubleshooting and special instructions for teachers and possible solutions for each activity are provided in the teacher's reference. The teacher's reference also includes extra, full-sized pictures for overheads or handouts as well as optional enhancement projects. A volunteer's page at the end of the manual gives speaking ideas for transportation professionals who visit the classroom.

****NOTE: Class visits by NDDOT TRAC volunteers are available for this module. These visits include a presentation on NDDOT's use of Impulse and Momentum principals used for designing safety barriers and video on crash testing safety equipment. Also a presentation on engineering is given.***