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Impact Car
4-79801

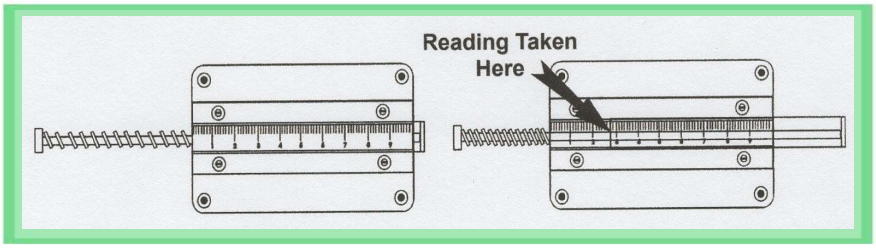
Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65 Warning: This product can expose you to chemicals including nickel, and lead, which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**

Introduction

The impact car is used to visually demonstrate the increase in momentum of an object as the mass increases. The car is equipped with a hollow body for adding mass and a gauge for measuring impact. The gauge has a linear scale for direct reading of the increasing force.

A spring loaded bumper rod extends in front of the car. When the car collides with an object or wall, the rod is forced inward which pushes a clear slide on top of the car. After the rod springs back to its original position the slide remains in place so that the student can then take a reading from the scale.

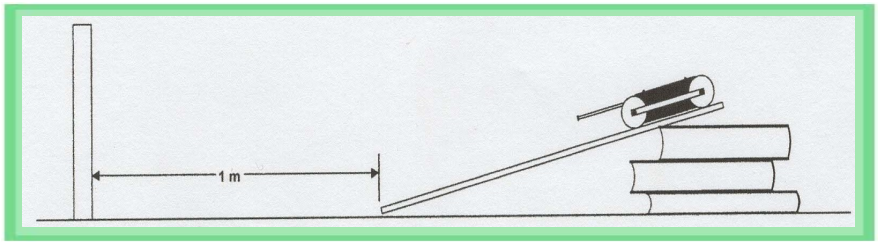


Momentum

Momentum is basically the quantity of motion. It is derived by multiplying the amount of mass and velocity. Mass is rather easy to determine by simply weighing the object. (We will disregard the fact that advanced theories of momentum indicate that an object's mass changes with speed. In this case it is too small for consideration). Velocity on the other hand is a little more difficult to calculate accurately without more sophisticated equipment such as a photogate timer. It is important that students understand that momentum is derived from a combination of the two variables, mass and velocity, however as an introduction to the concept we will only be primarily interested in the changing mass part of the equation.

Lab

To begin, have the students weigh the car in grams. Set up a ramp using a thin board and books. The distance from the ramp to a solid object such as a wall or a stack of heavy books can vary. This can be anywhere between 1 meter and 2 meters but once everything is setup do not move anything.



Now have someone place the empty car at the top of the ramp and another person measure the amount of time it takes for the car to travel from the top of the ramp to the initial collision of the wall or books. This can be done with a stopwatch or simply counting in seconds. This time is not very accurate but gives the student arbitrary time to factor into their equation. Under more accurate testing, this time would change as the mass changes, but for simplicity sake we will use this time for all of the experiments. Once again, it is important that the students understand that one very important variable is actually being disregarded.

Once a time factor has been established and the weight of the car determined, you are ready to begin. The beginning factors should be entered into a chart. Roll the car down the ramp and have the students record the reading of the scale on the top of the car. Now have the students add 50 grams of weight to the inside of the car and replace the top. Perform the experiment again and record the findings. Do this again with 100 grams and 150 grams of weight added to the car. It should become immediately obvious that the amount of force is increasing with the increasing mass. Students can multiply the mass of the car by the time factor to develop an idea of the amount of movement that is developing.

**Students may also try measuring the distance that the car rebounds each time that the mass is increased. This could lead to further discussions into Newton's laws and conservation of momentum.