# IMPULSE

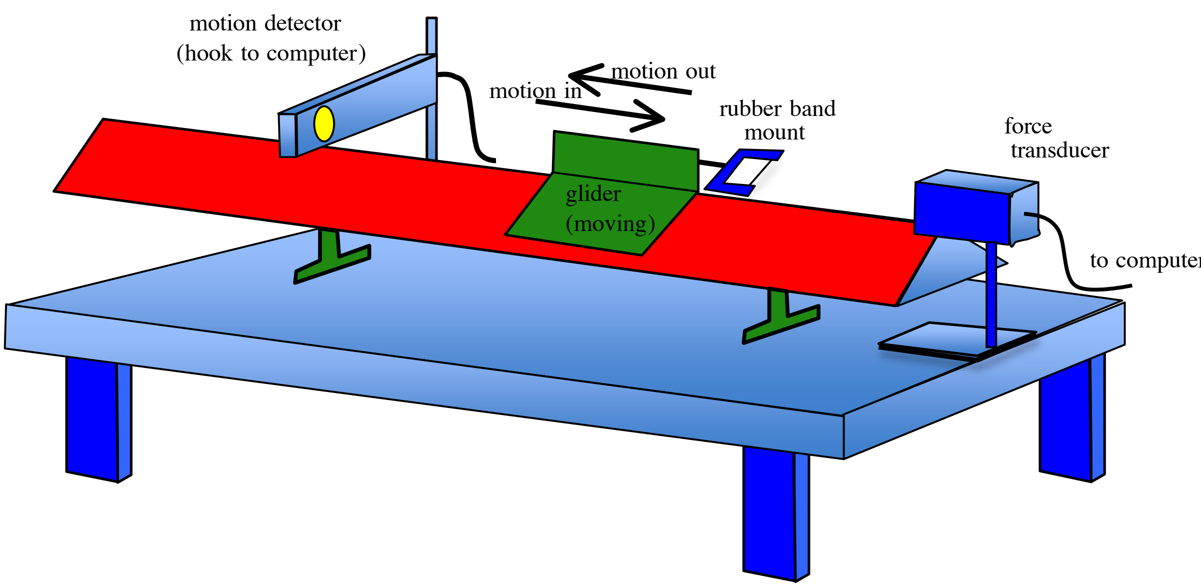
(L-12a)

Does the *impulse* really equal the mass's *change of momentum*? This lab will give you the opportunity to find out.

## PROCEDURE--DATA

**Part A:** (comparing the *impulse* **F**Δt to a body's *change of momentum* Δ**p**)

**a.)** In this lab, data will be taken to determine whether the *impulse* on a body during a collision is really equal to the body's *change of momentum*. To do so, a "frictionless" cart will travel down a *track* that has a sonic detector at one end (this device measures position and velocity) and bounce off a FORCE TRANSDUCER'S ARM located at the other end of the track. The Logger Pro program will give you a *velocity versus time* graph from which you can determine the glider's incoming and outgoing velocity and a *force versus time* graph from which you can determine the area under the *F vs t* graph for the collision (you will use the *integrate* function that Logger Pro provides—this value should equal the impulse provided by the transducer on the glider).




**b.)** You will be briefed on what data to take during lab. You will essentially end up with two graphs, a *velocity versus time* graph and a *force versus time* graph.

**Note 1:** Along the top, if you look at the Experiment pull-down, you should see a link called "Data Collection." In that, the amount of time for each run should be changed from 10 seconds to 2 seconds and the number of samples per second should be set at 200.

**Note 2:** The force transducer has to be calibrated, then zeroed.

**Note 3:** The Logger Pro program will give you a *force versus time* graph, a *position versus time* graph and a *velocity versus time* graph. You should delete the *position versus time graph* and make it so the other two graphs fill the page.

**Note 4:** The track needs to be leveled AT THE END (versus in the middle). Use the glider to effect this (if the glider is placed stationary on the track, then begins to move, the track isn't perfectly horizontal).

**c.)** Do the run. Record the incoming and outgoing velocities (you can use the cursor to do this—I'll say more during class).

**d.)** On the *force versus time* graph, use the *integration* function to determine the area under that graph for the period of time during the collision.

**e.)** It would probably be a good idea to print out both graphs when you are done.

**f.)** Determine and record the mass of the cart!

## CALCULATIONS

**Part A:** (relationship between *impulse* and a body's *change of momentum*)

**1.)** What was collision's impulse as determined by the area under the *force versus time* graph (your computer gave you this number)?

**2.)** We'd like to see if the impulse determined by calculating the area under the *force versus time* graph (Question 2 above) is the same as the cart's *change of momentum*. That is, is $\mathbf{F}\Delta t = \Delta\mathbf{p}$? To find out: We need to determine the single-glider's *change of momentum*. To do so:

**a.)** Determine the incoming and outgoing momenta.

**b.)** Determine the net change of momentum (including units) of the glider during the collision. BE VERY CAREFUL WITH YOUR SIGNS!

**3.)** As was stated above, the computer was kind enough to provide you with a numerical value for the area under the *force versus time* graph. Generated as a consequence of the glider's momentum-changing collision with the Transducer's ARM in our set-up, this area was $\mathbf{F}\Delta t$.

If our theory is correct, the glider's *change of momentum* determined in *Calculations 2* should equal to a real good approximation that $\mathbf{F}\Delta t$ value. Check it by doing a % comparison between the two. Comment.

## QUESTION

From what you did during the lab, what succinct thing can you say about the relationship between the impulse on a body and the force on that same body?