M-11b: Air Track Collisions **Name**_____
Lab Worksheet **Group member names**_____

This sheet is the lab document your TA will use to score your lab. It is to be turned in at the end of lab. To receive full credit you must use complete sentences and explain your reasoning clearly.

1. Familiar yourself with the operations of the gliders on the air track. Make sure the distribution of weight is balanced so that both gliders remain nearly stationary (i.e., minimizing the acceleration) after adjusting the leveling screw. Adjust the air flow so the gliders move freely without rocking side to side. You may have to adjust the leveling screw multiple times.
   Describe glider motions:_____
   _____
   _____

2. Make sure that the photogates are plugged into the first two phone jack inputs in the PASCO interface module.
3. Check the length of the 10.0 cm fence that sits atop each of the two gliders.
   Length of 1st glider fence: _____±_____
   Length of 2nd glider fence:_____±_____
4. Experiment I: First place the two photogates side by side. Now send a single glider back and forth three (or so) times (bouncing off the air track ends) while recording the passage time through each photogate, adjust the photogate heights and angles so that the passage times are nearly equal.

	Photogate 1	Photogate 2
Time 1		
Time 2		
Time 3		

   Approximately, what is the fractional loss in energy with each bounce?
   _____
   _____
   _____

5. Now set the two photogates approximately 40 to 50 cm apart and again adjust the photogates so that they again yield nearly equal passage times.

	Photogate 1	Photogate 2
Time 1		
Time 2		
Time 3		

6. Choose gliders of equal mass (or make them approximately the same by fastening weights on one) and make them ready for an elastic collision (see figure in lab manual). Qualitatively predict the expected outcome of the next step before attempting the experiment.
   Prediction for momentum:_____
   Prediction for energy:_____

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With glider #1 at the end of track and glider #2 at rest near the center, give #1 a push toward glider #2.
To help prevent confusion, stop glider #2 before it bounces back. As before you should perform multiple trials until you achieve consistent results and record a few of them. Use the balance to measure the glider masses.

Check conservation of momentum and energy in the impact. In equation,

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2,$$

and call velocities to the right positive, those to the left negative.

Glider	#1	#2
Mass:		
Velocity (before)		
Velocity (after)		
Momentum (before)		
Momentum (after)		
Kinetic Energy (before)		
Kinetic Energy (after)		

Change in momentum:	% Change in momentum:
Change in energy:	% Change in energy:

Do your results indicate that momentum is conserved? Energy?_____
_____
_____
_____
_____

EXPERIMENT II:
Perform the same procedure as Experiment I except start both gliders from *opposite* ends of the air track and with considerably different velocities.

Glider	#1	#2
Velocity (before)		
Velocity (after)		
Momentum (before)		
Momentum (after)		
Kinetic Energy (before)		
Kinetic Energy (after)		

Change in momentum:	% Change in momentum:
Change in energy:	% Change in energy:

Do your results indicate that momentum is conserved? Energy?_____
_____

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_____
_____
_____

EXPERIMENT III:

Repeat this experiment but now for inelastic collisions by attaching cylinders with needle and wax inserts (see figure in lab manual). Note that the needle *must* lines up exactly with the insert or there will be significant sideways motion when the two gliders strike. You may have to rotate both the needle and was plugs in order to make them collinear.

Glider	#1	#2
Velocity (before)		
Velocity (after)		
Momentum (before)		
Momentum (after)		
Kinetic Energy (before)		
Kinetic Energy (after)		

Change in momentum:	% Change in momentum:
Change in energy:	% Change in energy:

Do your results indicate that momentum is conserved? Energy?_____
_____
_____
_____
_____

EXPERIMENT IV:

Increase the mass of the first cart and again test for conservation of energy and momentum in the case of an elastic collision follow the procedure of EXPT I.

Glider	#1	#2
Velocity (before)		
Velocity (after)		
Momentum (before)		
Momentum (after)		
Kinetic Energy (before)		
Kinetic Energy (after)		

Change in momentum:	% Change in momentum:
Change in energy:	% Change in energy:

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Do your results indicate that momentum is conserved? Energy?_____
_____
_____
_____
_____

Does friction with the air track impact your results?
_____
_____
_____
_____
_____