

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.

Be sure to read through Chapter 10 of Knight before starting the lab!

1. Familiarize 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 from 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. Estimate the coefficient of kinetic friction, μ_k , between the gliders and the air track. Explain your approach.

M-11b: Air Track Collisions

Name _____

Lab Worksheet Group member names _____

7. 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: _____

With glider #1 at the end of the 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. Remember,

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2;$$

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? _____

M-11b: Air Track Collisions

Name _____

Lab Worksheet Group member names _____

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? _____

EXPERIMENT III:

Repeat this experiment but now for inelastic collisions by attaching cylinders with needle and wax inserts (see figure in lab manual). Be careful with these needles – no poking! Note that the needle *must* line 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 wax 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? _____

M-11b: Air Track Collisions

Name _____

Lab Worksheet

Group member names _____

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:

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

Does friction with the air track impact your results?
