

Physics

Conservation of Momentum

When two airtrack gliders collide on a near frictionless surface, the sum of the momentum should not change. Here you will test this.

1. You will need one lab partner, (Work in groups of 2), an airtrack, two gliders, a computer with Logger Pro on it, and an ultrasonic range finder.
2. **Mass** the two gliders and record this. Since the precision of our balances is 0.1 g, the uncertainty of the mass of the gliders is 0.05 g. Write down the mass in grams with a decimal. If it comes out even to say 301 grams, write it 301.0 g to show you measured the tenths place.
3. Level the airtrack. Run the momentum lab on the computer which will bring up a **velocity v time graph**.
4. Position the rangefinder so that it is pointing down the airtrack, but is some distance from the end of the track as it cannot "see" things closer than 50 cm. Place the glider with the flag sticking up on it on the airtrack, hit "Collect" on the graph window, and give the glider a gentle shove toward the far end of the track. You should see a nice flat velocity v time graph. (At least until it hits the far end) If the graph tilts then you don't have the airtrack level, if the graph turns into garbage at some point, then you need to aim the rangefinder better.
5. Place the glider with no flag on it in the middle of the airtrack at rest, sticky side toward the rangefinder. Place the glider with the flag on it between the rangefinder and the other glider, sticky side toward the other glider. Hit "Collect" on the graph window, and give the glider nearest the rangefinder a gentle shove toward the middle glider. Repeat this until the gliders stick together, and you get a nice graph that shows straight line velocities before and after the collision. (The graph will be flat, then step down and be flat again. Make sure that you aren't looking at a collision with the end of the track. i.e. the velocity goes from positive to negative)
6. Select a portion of the graph before the collision, and Choose "Statistics" from the "Analyze" menu. This will pop up a bubble with the Mean, Max and Min for those points. Do the same for some points after the collision.
7. When you have a nice graph, print it and it will print the statistics too.
8. Mass the gliders. (Be careful not to drop them.)

Here's what you turn in:

1. Your calculations on the total momentum of both gliders before and after the collision **written directly on the graph that you made**. For each calculation, calculate the **Maximum, Best Guess** and **Minimum** values the momentum could have been.
2. Your own personal answer to these questions:
 - A. "Does the data you have support conservation of momentum?" (Do the values overlap or not? – Cite specific numbers to back up what you say)
 - B. "What inherent properties of the apparatus and procedure could contribute to any discrepancies you may have found?" (Identify 2 or 3 sources of error)
 - C. How can you mitigate those sources of error?

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That's it - Just that **one sheet of paper**.