Lab 2: Momentum and more Vectors

Air Tracks

Please be careful with the airtracks. Although it doesn't look like it, they're actually somewhat fragile. If the track or the metal carts get bent, they glide well and the experiments won't work. Also, please do not rest the carts on the air track when it's not on. Turn the vacuum on and then put the carts on. And take the cars off before turning it off. Thanks.

Try out the following things. Make qualitative observations. Don't aim for quantitative, precise results.

1. Level the air track.
2. Take a cart and give it a shove. What happens to the cart? What interactions is the cart participating in?
3. Reproduce the experiment discussed in Figure C3.3.
4. Reproduce the experiment discussed in Figure C3.4.
5. Reproduce the experiment discussed in Figure C3.5.
6. Imagine a situation where a cart collides with another cart of equal mass that's at rest, and they stick together. What do you think will happen? Be sure to write down your prediction. Then do the experiment. Use duct tape to make the carts stick.
7. Repeat the above, but have a small car hit a light cart at rest.
8. Repeat again, but have a large cart his a small cart at rest.

A Brain Teaser

You have a drawer containing 8 blue socks, 10 green socks, and 12 orange socks. You would like to wear a matching pair of socks. You grab socks one at a time from the draw. What is the maximum number of socks you need to draw before you have a matching pair in your hands? (This has nothing to do with physics.)

Sextants

1. Trigonometry Warm Up:
   (a) You stand 50 meters away from a flag pole. You have to look at an angle of 53 degrees from the horizon to see the top of the pole. What is the pole's height?
   (b) You stand 75 meters away from a tree that's 100 meters tall. At what angle must you tilt your head so that you look straight at the top of the tree?
2. Trigonometry and Trees:
   (a) Grab a sextant. Go outside and figure out how to use it. (Talk to or Cecily.)
   (b) Measure the height of the large pine tree on the North end of the field between the Blair/Tyson and the arts and sciences building.

Scientific Notation and Estimation

First, some practice with scientific notation.

1. Convert the following numbers into scientific notation.

   (a) 123456
   (b) 0.000045
   (c) 77 billion
   (d) 945.670

2. Convert the following from scientific notation into regular decimals.

   (a) 3.4×10^3
   (b) 3.4×10^{-3}
   (c) 6×10^6

Next, some estimation, or "Fermi" problems. I'm looking for order of magnitude estimates, not precise answers! (This means correct to within a factor of ten.) You should round off with reckless abandon, and avoid using a calculator if at all possible.

1. Estimate the speed, in mph, at which human hair grows.
2. Estimate the average speed, in mph, at which a human grows from age 0 to 18.
3. Estimate the number of pounds of meat consumed at our dining hall every week.