6.1: Background Material

Text References

- impulse and momentum
- perfectly inelastic collisions
- elastic collisions

Force and Motion Sensors

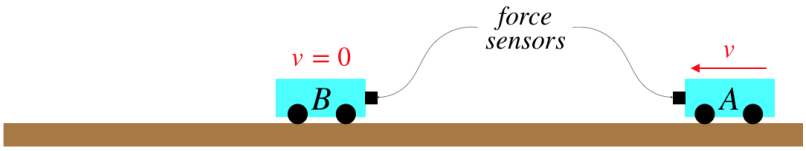
The equipment used in this lab includes two sensing devices that take data in real time. One of these is a force sensor (located on one end of the cart), which measures force exerted in Newtons, and the other a motion sensor (activated by the turning of the wheels of the cart), which measures velocity in meters per second.

Both of these sensors send their readings via Bluetooth to a laptop at regular intervals. Upon receiving this information, the computer plots the values versus time on graphs, the details of which we will use for our analysis. Forces are recorded as positive values when they push on the sensor, and negative values when they pull on it. Motion detected by the motion sensors is recorded as a positive value when the object is moving in the direction where the force sensor is in front.

The experiment involves collisions of nearly-frictionless rolling carts. As we are interested in the forces exerted on each cart as a function of time, we don't want the collision to be between two hard surfaces, or the period of time over which the forces act will be too brief to measure, even at the impressive sampling rate of our force sensors. We have therefore engineered the two types of collisions we will study so that the force of the collision occurs at a "leisurely" pace.

For simplicity, all of the cases we will study will involve a stationary target cart, but the conclusions of the experiment will be independent of this choice.

Figure 6.1.1 – Anatomy of the Collisions



We therefore will end up with four graphs plotted at the same time – a force and velocity for each cart. The information we extract from these plots will allow us to draw conclusions about impulse, momentum conservation, and kinetic energy conservation.