Objective:

Find the relationship between the mass of the cart and the acceleration of the cart.

Hypothesis:

The greater the mass of the cart, the lower the acceleration will be.

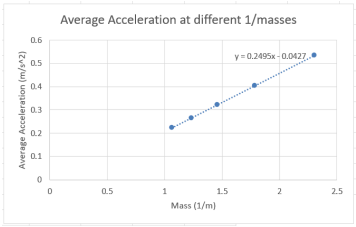
Procedure/Strategy

1. **Setup:**
   - Place the fan onto the cart on the track.
   - Place the cart at one end of the track.
   - Attach a string to a pulley
2. **Baseline**
   - Position the fan so it blows away from the pulley.
   - Attach 2 washers to the paperclip at the end of the string not connected to the cart.
   - Turn on the fan to level 4. If the cart moves away from the pulley, then increase the weight. If the cart moves towards the pulley, then decrease the weight.
   - Repeat until the cart is stationary.
3. **Calibration:**
   - Keep fan where it is, but remove pulley.
   - Turn on the fan to level 4.
   - Record and measure the acceleration without added mass
4. **Data Collection:**
   - Repeat the above process, but increase the mass of the cart by 126g (1 block) every time (3 measurements per extra block)
   - Record all data in the "Data" section below.

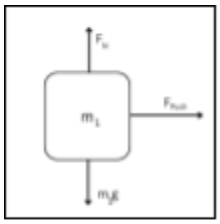
Data

Starting Cart mass (with fan): 433.5g

	Total Mass (g)	Acceleration Trial 1	Acceleration Trial 2	Acceleration Trial 3	Average Acceleration
No Added Mass	433.5	0.526	0.536	0.537	0.533
+126g	559.5	0.409	0.392	0.408	0.403
+251.7g	685.2	0.326	0.320	0.320	0.322
+377.5g	811	0.273	0.261	0.259	0.264
+504g	937.55	0.219	0.22 5	0.228	0.224



Analysis



The free body diagram in Figure 1 show the forces affecting on the cart in our experiment.

Figure 1: Free Body Diagrams

The force recorded from step 2 represents the net force produced by the fan, as friction is assumed to be 0. Therefore, we can use the equation below to calculate the acceleration at each mass.
The equation to calculate the total force is:

$$F_{Fan} = m_1 a$$

Grams are converted to kilograms in order for the formula to work. Accelerations at each mass level are then found. Lower masses experienced higher accelerations than higher masses. When graphing a vs 1/m, we found that the slope was 0.2495, which is the same as the force of the level 4 fan.