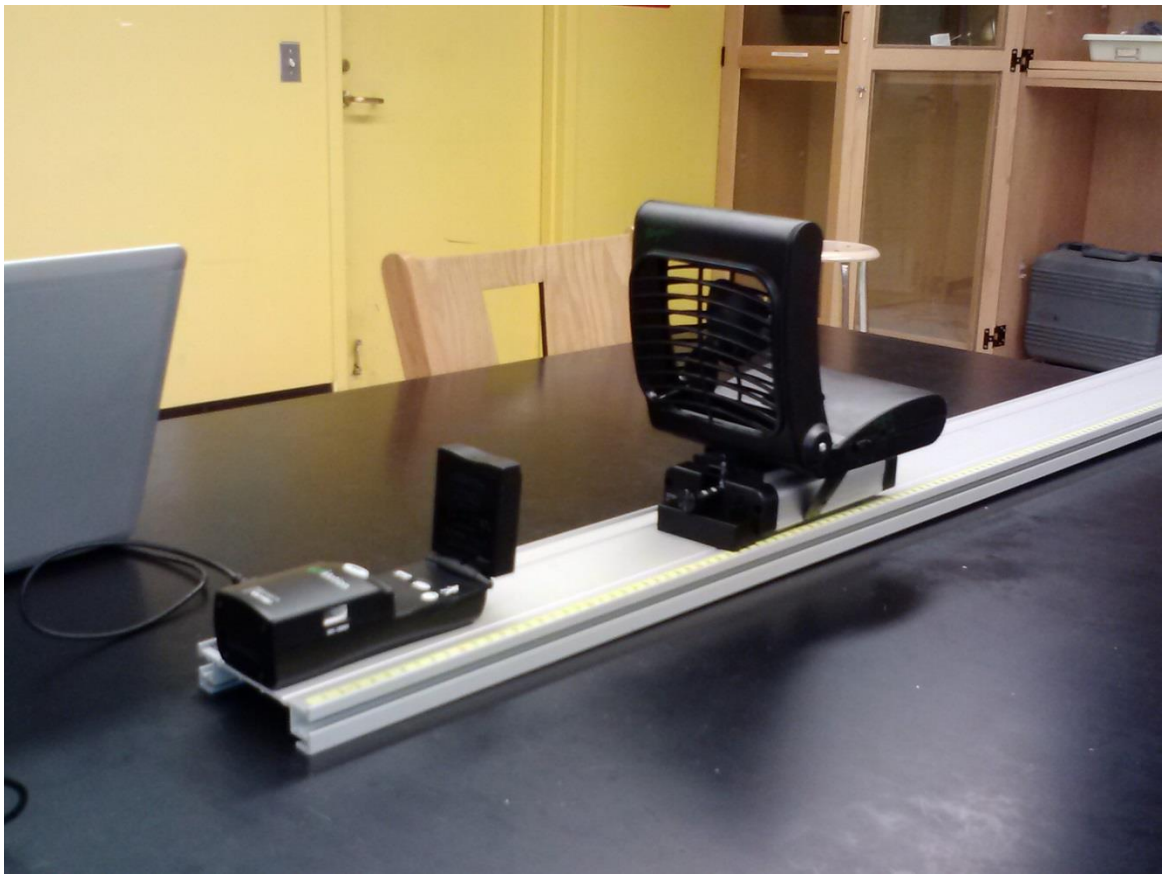
Newton's Second Law Lab

Station 1: Fan cart



1. Connect the motion sensor to one computer and open Logger Pro. You should see a position vs. time graph and a velocity vs. time graph on your screen.
2. Press the green "collect" button. After you hear the motion sensor clicking, turn the fan on and observe the motion of the cart.
3. Does it speed up, slow down, or move at a constant speed?

4. Right click on the velocity vs. time graph and auto scale it. Copy and paste the graph below. What can you say about the rate at which the velocity increases?

5. List the forces that act on the cart: (Friction on the cart is small enough that it can be considered negligible.)

6. Draw a free body diagram for the cart. Use insert, shapes to insert a rectangle for the cart and arrows for the force vectors. Use text boxes to label the forces.

7. Are the external forces acting on the cart balanced or unbalanced?

8. Conclusion: When the forces acting on the cart are (balanced/unbalanced), the cart (speeds up/slows down/moves at a constant speed).

Station 2: Pasco cart with hanging mass

1. Use a pulley and a 50 g mass hanging off the end of the table to pull the cart with a constant force.
2. Place a motion sensor at the end of the track. Connect the motion sensor to one computer and open Logger Pro. Press the green "collect" button. After you hear the motion sensor clicking, let the hanging mass pull the string which in turn pulls the cart down the track.
3. Does the cart speed up, slow down, or move with a constant speed?

4. Copy and paste the velocity vs. time graph here.

5. List the forces that act on the cart: (Friction on the cart is small enough that it can be considered negligible.)

6. Draw a free body diagram for the cart. Are the external forces acting on the cart balanced or unbalanced?

7. Stack the small disk masses in the blue box on top of the cart. Move one at a time to the hanger. When you increase the amount of mass on the hanger, this increases the tension in the string. As the tension in the string increases, what happens to rate at which the velocity increases?

8. While keeping the amount of mass on the hanger constant, add mass to the cart. As you increase the mass on the cart, what happens to the rate at which the velocity increases?

Station 3: Bowling ball vs. basketball.

1. Hit suspended bowling ball with bat and then the basketball. Try to use same force.
2. Compare the motion of the balls.

3. Why does one move more than the other even though the same force was applied?

Conclusion:

How does the acceleration of an object depend on the net force acting on it and its mass?